DOCUMENT RESUME

ED 250 525 CE 040 056

TITLE Microcomputers in Home Economics.
INSTITUTION Texas Tech Univ., Lubbock. Home Economics Curriculum Center.
SPONS AGENCY Texas Education Agency, Austin. Dept. of Occupational Education and Technology.
PUB DATE Oct 84
NOTE 162p.
AVAILABLE FROM Home Economics Curriculum Center, Texas Tech University, Box 4067, Lubbock, TX 79409-4067.
PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Citations (References); Computer Assisted Instruction; *Computer Managed Instruction; *Computer Oriented Programs; Computers; *Computer Software; Definitions; Exceptional Persons; *Home Economics; *Microcomputers; *Occupational Home Economics; Postsecondary Education; Program Development; Secondary Education

ABSTRACT

This document is an information guide for teachers that introduces computers into vocational home economics education classes. The first part points out implications of microcomputers for home economics classes, while the second part provides information on selecting, using, and maintaining computer hardware. The final section describes procedures for selecting, using, and storing microcomputer software. Topics covered in this section include computer-assisted and computer-managed instruction and using computers with special needs students. A glossary and references are included in the guide. Appendixes to the guide consist of software evaluation forms. (KC)

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Microcomputers in Home Economics

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Microcomputers in Home Economics

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Department of Occupational
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Vocational Home Economics Education
Austin, Texas

OCTOBER 1984

Acknowledgments

Microcomputers in Home Economics was prepared by the Home Economics Curriculum Center staff through funding from the Department of Occupational Education and Technology, Texas Education Agency, Austin, Texas, under Subpart 3, Program Improvement, of Public Law 94-482, in cooperation with the College of Home Economics, Texas Tech University, Lubbock, Texas. The Research Coordinating Unit, Texas Education Agency, coordinates all program improvement activities. The Division of Vocational Home Economics Education, Texas Education Agency, provides directional guidance to curriculum development projects.

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Preface

Microcomputers in Home Economics is an information guide for teachers that introduces computers into vocational home economics education classes. The text points out implications of microcomputers for home economics classes; provides information on selecting, using, and maintaining computer hardware; and describes procedures for selecting, using, and storing microcomputer software.

The microcomputer has made a tremendous impact on our lives and will continue to affect our futures. Home economics teachers have the opportunity to become leaders by helping individuals and families select and effectively use microcomputers and software in the home. As educators, home economics teachers have an opportunity to utilize the microcomputer as a teaching and classroom management tool. Teachers should also be aware of the potential benefits, the effects on privacy, the effects on individuals, and the potential health hazards of computers—and address these issues in their microcomputer instruction.

To efficiently integrate the microcomputer into the home economics classroom you must build a computer system that meets your needs. Teachers must carefully select the basic components and additional components needed to expand the system. Studying user's manuals and other references and learning to effectively use the computer system takes time and effort. At some point you may want to become more than a user of existing computer software by learning to use authoring software or a programming language in order to create your own programs. You will also need to be able to care for and obtain repairs for the components of your microcomputer system.

An understanding of computer assisted instruction and computer managed instruction is required in order to use computer software effectively. In addition, teachers can explore the possible uses of the microcomputer in working with special needs students. Once potential software applications are identified, the software must be selected, evaluated, cataloged, and stored.

Microcomputers in Home Economics describes possible applications for computers in our educational system. This does not mean, however, that the microcomputer is an effective way of teaching all objectives. For every application, consideration should be given to whether the microcomputer is the most effective and cost-efficient teaching tool available. Teachers should decide when and how computers are most useful for instruction and learning. The time to begin exploring the possibilities for the use of computers in home economics is now.

Part I
Microcomputers–
Implications for Home Economics Classes

The Microcomputer– Here to Stay

Chapter 1

In communities across the country, Americans are racing to buy microcomputers. The "micro" is the talk of the 80s in business circles, social groups, and playgrounds. What these machines can do for us is exciting. With them we can educate and evaluate, entertain and communicate, plan and keep records, analyze and manage. We can use these machines to control our environment and as tools for coping with our increasingly complex world. The microcomputer is rapidly changing the way we live, work, and play as did the telephone, the automobile, and the television. A brief look at the rapid development of the computer and its role in current technological trends leads us to one unmistakable fact–the microcomputer is here to stay– at home, in schools, in business and industry– today and in the future.

At Home

The computer indirectly touches the lives of every American family today. Most bills and payments are processed by computers. Inventories in the retail outlets where people shop are maintained by computers. Most banking is conducted via computers. Mail is computer sorted. Traffic lights are often computer-controlled. The list of uses is endless.

The computer affects families directly when it moves into their homes. Entertainment and educational opportunities are the primary attractions for buying microcomputers, especially in homes with young children. Families also buy microcomputers to manage home records and financial accounts. Many Americans families already own microcomputers. However, a 1983 *Consumer Reports* survey indicated that fewer than half (46%) of those surveyed bought their microcomputer only for home use; 41 percent had intended to use it for both home and

business purposes; and 19 percent had bought their microcomputer primarily for business purposes. In more than three-fourths of the households surveyed, someone in the family had received formal computer training or used a computer at work or in school.

The average family in the *Consumer Reports* survey spent about 15 hours a week using its microcomputer. About half the families used their microcomputers more than expected, especially if they used them to play games. (Games are the best-selling type of computer programs.) Children used the computer more than anyone else in the family. The most frequent applications were playing games, learning about computers, and learning to program. Of the user families, 59 percent used their microcomputers for word processing, 45 percent for home accounting (fewer than *expected* they would), and 34 percent to run educational programs (fewer than *thought* they would). Still the *Consumer Reports* survey documents that home computers are being used today and all indications are that they will be used at home even more in the future.

In Schools

Many people believe that microcomputers will revolutionize education. The microcomputer makes possible instructional activities that previously were simply impossible or unfeasible in the school setting. The microcomputer offers the possibility of truly individualized instruction tailored to fit the special needs of each student. The microcomputer can stimulate the unmotivated student to learn. It can also stimulate a student's thinking abilities.

The microcomputer has many potential uses in home economics classes. Here are a few examples. Home economics students can use the microcomputer as a tool in doing dietary analyses. Not only can the analyses be made more quickly and accurately than by hand, but students receive immediate feedback regarding their dietary habits. The microcomputer can give home economics students simulated experiences in managing family finances, drill and practice in food preparation terms or metric measurements, or tutoring in the math skills needed in food preparation or clothing construction.

Home economics teachers can teach students about computers and the potential impact of computers on their lives. Here are sample ways that computers could be included in home economics subject areas. In consumer education, students might learn how to buy computers and computer programs. In food and nutrition, students might explore the computer's potential impact on food preparation, menu planning, and grocery buying. In child development, students could develop guidelines for selecting computer games and educational programs for young children. In family living, students could predict the impact of the microcomputer on family relationships or lifestyles. In

family/individual health, attention could be given to safety and health issues related to computer use. In home management, students could compare traditional and computer recordkeeping. In housing, students could design facilities for incorporating the microcomputer into the home.

Already there are an estimated 200,000 microcomputers in U.S. elementary and secondary schools. Most schools with microcomputers have only one or two computers, but the numbers are growing fast. Increasingly more local and state boards of education are adding courses in computer literacy and computer use to meet minimum graduation requirements. Industry studies predict there may be 300,000 to 650,000 microcomputers in the schools by 1985. It is likely that almost every school will have one or more microcomputers by 1990.

In Business and Industry

The number of uses of computers in business and industry is growing so quickly that this growth is difficult to track. Knowledge of computer applications in business and industry is useful in developing an understanding of our increasingly computer-oriented world.

Computers have ushered in a new era in retailing. The food industry's adoption of the **Universal Product Code** made possible the use of scanning systems to read the code. The resulting scan-and-bag system is faster than the ring-and-bag system. Checkers make fewer mistakes with the scanning system, and new checkers only need minimal training to achieve an acceptable level of performance. The customer's receipt provides much more information than before.

Customer services have been increased and costs lowered through expanded use of computers in banking. The teller terminal system puts tellers directly in touch with computer files. This means that any service offered at one bank branch can be made available to that same customer at all other locations. The system can be used for handling checking account deposits and withdrawals, savings account updates, repayment of loans, name and address updates, money orders and tellers checks, and accounting.

Computer applications in business are expanding rapidly. Business applications include: billing and invoicing, accounting, order processing, payroll management, word processing, economic forecasting, delivery scheduling, stock market analysis, insurance premium accounting, inventory control, job placement, farm management, bank check processing, and computerized telephone services.

A second "industrial revolution" is occurring in the United States. Microelectronics are the heart of this revolution. The development of tiny chips of silicon imprinted with thousands

of electronic components has already transformed an astonishing range of products and processes. These microelectronic silicon chips are the electronic "brains" of computers, computerized equipment, and industrial robots being used to automate a broad array of tasks in factories. The impact on society of this new electronics revolution may be even greater than the impact of the original Industrial Revolution.

Computerized equipment is being used in all stages of manufacturing from design, through fabrication, to assembly. In many cases, the equipment is being substituted directly for workers.

Microelectronics are revolutionizing such diverse industries as the automobile, textile, and steel industries. In the automobile industry, most of the welding, paint spraying, and similar heavy tasks are being performed by electronic robots. In the textile industry, computerized equipment is being used for textile design, pattern drafting, pattern sizing, pattern layout, cutting, and sewing. Operations using computerized equipment generally require a fraction of the work force employed in older, manually operated plants.

It is clear that microelectronics will have a major impact on the job skills needed in the future. Many workers in manufacturing will be displaced by the new technology while jobs in communications, sales, banking, and services will increase.

Today and in the Future

That the computer is having a tremendous impact on our lives today is obvious. Equally obvious is the likelihood that it will have an even greater impact on our families, our education, and our work in the future. Both children and adults will have access to the kind of computing power once reserved for governments, research institutions, and large corporations. In fact, it seems inevitable that within a few years almost every American family will have ready access to computers and computer technology.

Microcomputers have continued to get smaller and lighter—we can carry one with us wherever we go. It can receive coded radio signals as well as news. It can be used to receive and interpret satellite transmissions. We can plug in data bases or the latest popular books. We can even talk to our big computer at home.

As the microcomputer continues to improve, it will be able to accept voice commands and respond in its own voice. It will become easy enough for a child to operate but be sophisticated enough to challenge the most creative adult. We will use it to retrieve quotes from the Wall Street ticker and this week's supermarket sales prices, as well as almost any type of information we could possibly desire. What is now available on paper

will be electronically accessible within seconds. These possibilities are rapidly becoming realities.

Using the microcomputer, work can be done at home. The results of that work can be transferred through a computer network to a computer at a downtown office or even to another city, state, or country. Salespeople can make their calls from a microcomputer instead of a car. Teleconferences can be held instead of business meetings and conferences as travel costs continue to increase. Connection of the microcomputer and videotape recorder will permit such interaction to occur in an astonishingly "live" fashion. Alvin Toffler, author of *The Third Wave*, refers to the possibility of working at home via computer as a trend paralleling the cottage industries of the 19th century. Toffler refers to the home industries of the future as "electronic cottages."

As the "electronic cottage" becomes a reality, so may the electronic schoolhouse. Some educators predict that books and schools will disappear. Others feel that the computer will simply change the focus of education from memorizing lists of information and facts to learning how to learn, how to acquire information, how to synthesize it, and how to put it to effective use. The facts will be readily available from ever-expanding data banks.

In the future, the computer may prepare individually designed tests based on each student's educational profile. The computer will then correct the test, give the student a grade, and present the teacher with an outline of the student's strengtns and weaknesses. The teacher will interpret this information and prepare an educational plan for the student. Students will be able to move to advanced courses when they are ready or receive remedial instruction as needed. The teacher will be able to track the student's progress with fewer errors.

The computer may change the role of the teacher from information dispenser to advisor, counselor, and socializer. The teacher may also have an important role in helping students learn to acquire, organize, and use all the information available to them.

In the year 2001, individuals will be able to study what they want, when they want, and at their own level. Self-learning may become the leading form of education. In addition we may, by necessity, become lifelong students in order to continually adapt to the changes of the information society.

Predictions of the computer's potential impact on our lives are far-reaching. Reality probably lies somewhere between the extremes. Our imminent future will probably be neither Utopian nor Orwellian, but the future will be different than the present. We must begin now to learn how to manage our lives in a computerized society because the microcomputer is definitely here to stay.

A Brief History of the Computer

Did you know that . . .

- The history of the computer can be traced to the abacus?
- The first automated digital computer, the MARK I, was constructed in 1939?
- The first fully electronic computer, ENIAC, weighed 30 tons, took up 3,000 cubic feet of space, used 140,000 watts of power, and had 18,000 tubes (which blew out on the average of one every seven minutes), and had to be completely rewired to program?
- The first "micro," manufactured in 1974, weighed about 30 pounds, had about the same amount of computing power and calculated 20 times faster than ENIAC, but took up only two cubic feet of space?
- Operations performed in milliseconds (thousandths of a second) in the computers of the 1950s could be performed in picoseconds (one-trillionth of a second) by the 1980s?
- As recently as 1970 the average person rarely had direct contact with a computer system?
- In 1974 there were only 162,000 computers in operation in the United States, but that by 1980 the number climbed to more than a million?
- Today's smallest microcomputers weigh about a pound, yet are both more powerful and faster than the earliest computers?
- The computer is one of the few things that has consistently gone down in price since it was invented?
- If the automobile had developed at the same rate as the computer, according to Christopher Evans in his book *The Micro Millennium*, today you would be able to buy a car comparable to a Rolls-Royce for about $2.75 and that car would get about three million miles to the gallon of gas and would have enough power to drive the Queen Elizabeth II?
- Civilization as a whole is moving into an information age in which a computer-literate populace will be as important as energy and raw materials?
- At least one percent of American homes already possess a microcomputer?
- New programming languages have made it possible for even lay persons to program computers?
- The computer is rapidly changing the way Americans do things at home, at school, and at work?
- Over half of the U.S. labor force is now in information occupations–jobs that frequently involve use of computers?

Computer Applications in the Home Economics Curriculum

Chapter 2

Historically, home economics has assisted families in meeting their needs. The needs in our ever-changing society have moved from production to consumption to the dawning of the Age of Information. Technology has been at the root of all these changes and will continue to be important for solving problems of individuals and families in the future. Home economics professionals should accept the challenge to become aware of new technologies, understand their impact on our work and our lives, and help others use technology to benefit individuals and families. The day when the average consumer owns a microcomputer is not yet here, but the computer is already causing dramatic changes in the lives of the people we teach. Home economics is in a unique position to help individuals and families balance the human side of their lives with the impact of new technologies.

Home economics programs must prepare homemakers for the electronic home of the future. Because of the computer's role in the electronic home, computer use should be incorporated into the home economics curriculum. Students are already coming into our classrooms with a basic knowledge of the computer, but not of its implications for themselves and their families. Supplying students with information *about* the implications of computers in people's lives should be one of our goals.

Many *aspects* of home economics subject matter apply to instruction that uses the computer as a teaching tool. Software already exists for teaching *with* the computer in every subject area in home economics. Teaching with the computer can aid in individualizing instruction to better meet students' needs and free class time for other activities. See the chart on page 21 for a list of home economics topics for which software is currently available.

We cannot ignore the computer either as a teaching aid or as a force in our society. We must consider ways to teach *about* the computer and to teach *with* the computer in home economics classrooms. Following are suggested applications for incorporating instruction about the computer in every subject area of home economics, in instruction about home economics careers, and in FHA/HERO activities.

Child Development

Tomorrow's parents will need computer information to educate their children. Already specially designed software packages can teach preschoolers to read, write, and compute. Software has also been designed to assist high school students with preparation for college boards. Microcomputers are making a difference in children's ability to learn and in their enthusiasm for learning. In addition, computers can individualize instruction so that children can work at their own level and pace. Parents will need guidelines for selecting and using software for children and for evaluating specialized computers designed to teach children sounds, spelling, reading, and facts.

In addition to knowing how to select computers and software for children, parents need guidelines for monitoring children's computer use. Like anything else, even learning with a computer can be abused. A child who spends too much time on a computer may not develop the social skills that are necessary for adult living. In addition, possible effects of long-term computer use on a child's growth and development should be considered. Long-term effects of computer use are open to research.

The following activities are designed to teach consumer and homemaking education students about selecting software for young children and monitoring their computer use:

- Invite a day care center director and an elementary school principal or teacher to discuss uses of microcomputers in the education of young children.
- Provide students with several articles on present and future uses of microcomputers in education. Then conduct a brainstorming session to identify ways microcomputers may affect children's educations in the future. What types of educational software are already available for young children? What are some signs of quality in educational software? How might computerized education affect the development of social skills?
- Guide students in investigating ways that the computer can be used to enhance the development of children. Have students demonstrate how to teach children specific concepts and skills using a microcomputer.
- Conduct a brainstorming session to identify possible benefits to children of having a home computer. Do you feel that children will suffer irreparable deprivation without a home computer? What might be some detrimental results of computer use by young children?

- Divide students into groups to develop guidelines for selecting software to use with preschool children, primary age children, and older elementary age children. [NOTE: You may need to provide students with information regarding characteristics of each age group.]
- Ask students who have computers in their homes to observe a younger child in the family using the computer. Observations might include the child's posture, signs of fatigue or eyestrain, level of interest, types of programs used, and skill in using the computer. Discuss the students' observations in class.
- Take a field trip to a nearby elementary school to observe children using microcomputers. Discuss with the computer resource personnel the use of microcomputers with younger and older elementary children. Have each student write a short report about the field trip.

Clothing and Textiles

Today, computers are used in textile design, apparel manufacturing, and retailing. Computers grade patterns, control the looms that weave fabric, cut and mark fabric, facilitate work flow, process orders, and control shipping. In retail clothing stores computers are used for ordering merchandise, maintaining inventory records, recording sales, staffing, and security. Awareness of these uses can help students develop consumer skills and prepare for careers in the clothing and textiles industry.

In the classroom, the microcomputer through visual display can be used to teach students information about textile fibers and their characteristics, textile and sewing terminology, and the elements and principles of design. It can also be used to teach pattern selection and use, fitting principles, and care techniques.

The following activities are designed to teach consumer and homemaking education students about the uses of computers in apparel manufacturing and retailing:

- Show a film on apparel manufacturing. Discuss the role of computers in the manufacturing process. How do these uses of computers benefit consumers? manufacturers? retailers?
- Take a field trip to a retail clothing store. Discuss ways computers are used in retail clothing stores. How do these uses of computers benefit consumers? retailers?
- Take a field trip to a garment and apparel factory where computerized equipment is used. How have computers been used in apparel manufacturing?

Consumer Education

Computers are being used to teach a variety of concepts in consumer education, and many software programs are available. Whenever possible, compare and evaluate software designed for the same purpose. Comparisons should include ease of use, accuracy, and number and type of applications possible.

For home use, a wise consumer will know that the computer is not a magic solution for every task. Many tasks can be accomplished less expensively and more efficiently with simple, readily available tools and equipment. For other tasks, the home computer can be very helpful if the user knows how to use it effectively.

Selecting a computer system requires considerable knowledge and skill. Home economics teachers can help students learn to apply the classic rules of consumer decision making practices to buying a computer system. Home economics teachers can help students consider the impact of computer technology on themselves and on other consumers.

The following activities are designed to teach consumer and homemaking education students how to select and use a microcomputer system and software and how computers can affect consumers now and in the future:

- Invite a guest speaker such as a microcomputer sales representative, county extension agent, or school computer expert to discuss the various uses of microcomputers in the home. How is the microcomputer used now? What uses are anticipated in the future?
- Conduct a school survey to determine how many students have microcomputers and the most popular brands and models. Share the findings in the school newspaper.
- Have students survey computer owners to find out what brand and model they own and what they paid for their system. How much did they pay for the basic computer system—central processing unit, keyboard, monitor, cassette player or disk drives, and their connecting pieces? for other peripherals—printer, modem, and joysticks? for software—tapes, disks, cassettes? Average the costs by brand and model computer. Use the results to design a graph showing what the average owner of each type computer spends on basics, other hardware, and software.
- Assign students to investigate the availability of computer products from local and mail order sources. How long has each source been in business? Do you know persons who are satisfied customers? What are some advantages and disadvantages of the source?
- Take students on a field trip to a computer store to see computers demonstrated and to talk to salespersons. Divide students into groups to study microcomputers, peripherals, computer books and periodicals, and software available for home use. Use the information gathered as a basis for class activities dealing with computers.
- Using the information collected on the field trip, have students compare the features of several computers. Compare memory capacity and expandability. Discuss availability and quality of sound, music, and graphics on each of the computers. What about color? When obtainable, how many different colors are available? Compare the features of the membrane and typewriter-style keyboards, discussing the advantages and disadvantages

of each. Study the availability of software. What types of software—games, educational, business—are available for each type computer and how abundant are they? Compare costs. What is included in the basic cost of each computer? What are the extras? Do you need a monitor or can you use your TV? Use the combined information to create a computer buyer's guide. [NOTE: Groups may be assigned specific questions to answer.]

- Divide students into groups to research one of the data base services available. How much does the service cost? What programs offered would be of interest to homemakers? to hobbyists? to children? to game players? to business persons? to persons seeking education?
- Have students survey home computer owners to learn their intended and actual applications of their computer. Students should ask owners whether they intended to use their computer for specific purposes and then whether they are actually using it as intended. Possible applications include: games, learning about computers, learning to program, word processing, home accounting, technical calculations, general education, business accounting, telecommunications, and writing programs for sale. Compile the survey results in percentages for each intended and actual use.
- Search newspapers and periodicals to find answers to the following questions: What new developments in the computer field will have an impact on consumers in the near future? What home-related tasks can be done using a computer? In what ways will these developments affect consumers? Share the articles with students and discuss the questions.
- Invite a local banker to describe how computers are used to make electronic fund transfers (EFTs). Which of the following services are available locally: automated teller machines or 24-hour tellers, pay-by-phone systems, direct deposits or withdrawals, point-of-sale terminals? What rights and responsibilities related to the use of EFTs does the consumer have? What are the advantages and disadvantages of EFT use to consumers?
- Ask if any of the students' families pay bills by phone or use their Touch Tone telephones to transfer funds. Do any of the families have their paychecks automatically deposited or pay fixed monthly bills automatically from their accounts. If so, these students' daily lives are influenced by computers. Discuss the many ways computers touch the lives of most Americans each day.
- Ask students to define *telebuying* (the process of buying via a data base and computer). Identify and define terminology needed to master this service. Consider the potential benefits of telebuying, such as avoiding crowded shopping areas, savings in gasoline, more leisurely shopping, greater group decision making within the family, and more comparison shopping. Consider the potential problems which might result from telebuying, such as overbuying, inability to see the product, and changes in family decision making power. Will telebuying create more pressure to keep up with the Joneses? Could

telebuying result in greater consumer confusion? What will be the social impact of *not* having telebuying equipment? What will be the effect of telebuying on local retailers?

- Ask students to imagine what it would be like to make purchases via a television-computer system. Ask students to compare store purchasing with telebuying. What are the advantages and disadvantages of each? What adjustments would be needed for effective shopping?
- Assign students to interview consumers to find out their reactions to telebuying. Students should record both positive and negative reactions and report to class. Were persons surveyed concerned about not being able to see products, about missing the "fun" of shopping, about potential loss of privacy, and about added temptation to buy?

Family/Individual Health

Computers are rapidly changing health care in America. The rising cost of medical care has created a trend toward more home care. This trend has spurred the development of computerized devices for monitoring one's health at home. For example, at-home electronic physical examinations are just on the horizon. Within the next few years, it is expected that one million Americans will use computers and electronic devices to monitor their health, including diets and exercise.

Increased health care knowledge and awareness and communications technology will shorten hospital stays by allowing patients to monitor their progress at home. Monitoring devices will allow some elderly persons who are presently cared for in nursing homes to remain independent and live on their own. Home computers will mean that the advice of the best physicians will be available to consumers along with self-monitoring of diet, exercise, stress, and personal fitness programs.

Individuals and families will be concerned about the actual and potential impact of computer use on their health. Concern has been expressed over the potential hazards of radiation, eyestrain, backache, fatigue, heat, noise, and stress. Most of these health concerns are related to prolonged computer use. However, as computer use increases they will become everyone's concerns.

The following activities are designed to teach students how computers are affecting health care services, home health care, and individual and family health:

- Invite a health care professional to discuss ways computers are helping the medical profession provide better services to individuals and families. How are computers used in various aspects of health care?
- Take students on a tour of a health care facility to see how computers are used. How are computers used in receiving and admitting, in billing, in patient records? How are computers used to talk to computers in other cities to meet patients' health care needs?

- Assign students to read articles describing the impact of computers and electronic technology on home health care. How can computers and electronic devices be used to monitor health, including diet and exercise? How may communications technology make possible monitoring devices which will allow elderly and terminally ill individuals to maintain their independence? What changes in health care knowledge will be necessary to use such devices?
- Have students investigate the implications of increased computer use for family/individual health. Will visual fatigue or more serious physical effects likely result from computer use? How serious is the threat of radiation from color monitors? Can hearing loss result from the decibel level of the sounds produced by the computer? How can eyestrain be prevented? How can backache and fatigue be prevented when using a computer?
- Ask students to interview anyone they know who uses a computer at home or on the job to learn what physical effects, if any, they have experienced as a result of using a computer? Has the person experienced stress related to computer use? If so, what can be done to reduce the amount of stress experienced? Discuss the results of the students' interviews in class.

Family Living and Parenthood

Home economics classes provide an ideal setting for addressing the potential effects of computers on the lives of individuals and families. Among the potential effects are: the increased likelihood that the privacy of individuals and families will be violated, the tendency of people to feel dehumanized by number-crunching computers, and the increased degree of isolation implied by the "electronic cottage" as a work place. The fact that more people are working at home can change family lifestyles. The introduction of computers into the home is changing our family lives, our child rearing practices, our recreational pursuits, and our interpersonal relationships.

In particular, difficulties can arise when one family member is enthusiastic about computers while others are not. When one member of the family fails to involve others in the decision to purchase a computer, the others may feel excluded. If one person is devoting time, money, energy, and attention to a computer while other family members are ignored, resentment may result. Some individuals may become impatient with family members when their behavior is not as easily controlled as that of the computer. Some families have used computers to strengthen family relationships. The process of learning about the computer and its applications can be turned into a family project. Educational software can offer remedial home instruction and games can provide family recreation. Both types of software can be used by children, with the help of their parents.

The following activities are designed to teach students about the potential effects of computers on the lives of individuals and families:

- Have students make a list for one week of all the contacts they have with computers in their lives. Compile a class list. Also discuss and include on the class list possible contacts of which students may not have been aware, such as computer processing of bank statements or credit card bills. Discuss ways the computer affects family life today and may affect family life in the future.
- Ask students to discuss their feelings about computers storing private information about a person's psychiatric problems, medical and police records, alcohol and drug consumption, shopping habits, credit record, income—and even high school grades. What types of information should be readily available (examples: blood type, allergies to medications)? How could information stored in computers be misused?
- Have students locate news stories about people whose privacy was invaded by computers. Examples might also show how computers sometimes cause problems for individuals due to erroneous information.
- Explore with students the potential impact of the computer on the right to privacy. Debate the topic: "Computers are dehumanizing and depersonalizing Americans."
- Assign students to investigate Congressional efforts to protect our privacy. For example, what were the purposes of the Fair Credit Reporting Act of 1970 and the Privacy Act of 1974? To whom do these acts apply? What gaps currently exist in privacy legislation? Are attempts underway to pass additional privacy legislation?
- Ask students to interview five persons they know to find out if they have been the victim of a computer error. If so, what type error was made? How was the error discovered? What did it take to get the error corrected? How did the person feel about the error? about the computer? about the business or agency responsible for the error? about the correction process?
- Analyze with students changes which may occur in the future as a result of increased numbers of Americans working at home via computers. These changes might include adjusting work and household responsibilities, having increased leisure time due to time saved on commuting, and dealing with interpersonal/family relationships because of more time spent with family.
- Discuss the potential influences of computer technology on family communications, productivity, happiness, and roles. How might the computer contribute to feelings of exclusion and resentment of some family members? How might the computer affect the power structure of the family?
- Discuss how Henry Thoreau's statement "Lo men have become tools of their tools" could be applied to the computer revolution. How can computer technology be used to liberate rather than to enslave individuals?
- Predict ways computers will affect technology, society, and families in the future. Compare these changes with the changes which resulted from the introduction of electricity, telephones, or television.

- Read Toffler's *The Third Wave*. Write a report comparing family life today with Toffler's view of family life in the computerized home and world of tomorrow.

Food and Nutrition

Computers are affecting food buying and menu planning both at the grocery store and at home. At the grocery store, Universal Product Codes and the resulting computerized scan-and-bag system are rapidly changing the grocery shopping experience. At home, computers are enabling consumers to quickly analyze their diets, plan nutritious menus, and generate shopping lists. Some consumers are even using their microcomputers as electronic recipe boxes.

The following activities are designed to teach students about ways computers are changing grocery shopping and ways students can use a computer at home to improve their diets:

- Point out the Universal Product Code on food products. Explain the purpose and uses of the code. How has use of Universal Product Codes changed supermarket shopping? What effect have they had on price marking of packaged grocery items? How have they affected checkout procedures? What are the advantages and disadvantages to consumers?
- Take a field trip to a computerized grocery store. Invite the store manager to explain ways the computer is used in the grocery store? What are the advantages to the store? to the consumer?
- Discuss with students the advantages and disadvantages of using a computer for storing recipes, maintaining a food inventory, and planning menus. What costs are involved? What skills are needed? How would location of the computer in the home affect its usefulness for these purposes?
- Ask students to interview five homemakers to find out how they would feel about trading their plastic recipe box for an electronic version of the same. Do they feel that this is an appropriate use of the computer? How might a person's temperament and organizational practices influence this decision?
- Invite a dietitian to describe ways a computer can be used to assist persons on special diets in meeting their dietary needs. How do dietitians use computers in planning and managing the diets of patients? What are some other uses of computers in dietary food service?
- Have each student prepare or run a basic recipe program on the computer.

Home Management

Computers are a new tool for helping family members manage information and devices. Computers can assist in home management as a filing cabinet, a bookkeeper, an analytical problem-solver, and a home security device. As a filing cabinet, the computer can efficiently and permanently store information for future retrieval or analysis. It can store family, medical, tax, or

inventory records. It can maintain records of home and auto maintenance; store purchase schedules; or file hobby, exercise, or health diaries and logs. It can maintain Christmas lists, addresses, or similar information and retrieve them on demand. As a bookkeeper, the computer can balance checkbooks, reconcile bank statements, post expenditures, and compare income with expenses. As an analytical problem-solver, it can determine energy consumption, figure car depreciation, retrieve tax information, analyze mortgage and amortization schedules, determine investment gains and losses, and more. As a home security device, it can control burglar alarms, fire alarms, the temperature, the lights, and electric appliances.

The following activities are designed to teach students about ways computers can aid in home management:

- Divide students into groups to develop descriptions of the impact of each of the following technological advancements for the family: radio, movies, street lights, telephones, central heating, automatic washing machines, automobiles, and television. As a class compare the impact these technological advancements have had on the family with the potential impact of the microcomputer. Consider both positive and negative ways each advancement has affected individual values, social interaction, the family power structure, socialization of children, the family's daily activities, and management of the home. How is the microcomputer similar to and different from the other major technological advancements of this century? What has been the role of technology in the changes in lifestyles, values, and quality of life?
- Ask students to check their homes carefully for computers that they may not even realize are there—such as in microwave ovens, dishwashers, washing machines, or even cars. Does the home have an automatic setback thermostat? Does the family use a programmable hand-held calculator? Do children in the family have computerized games and devices which add, speak, spell, or make logical choices?
- Have students conduct experiments that compare the solutions to homemaking problems with and without the aid of the computer. Comparisons might be made for bill paying, recipe use, using mailing lists, inventories, appointments and scheduling, tax accounting, health records, etc. How much time is required to set up each system? What are the advantages and disadvantages of each system? How much does each system cost? How much knowledge is required to use each stytem?
- Ask students to interview home computer users to find out what home management software they have tried. Did these computer users find their efforts worthwhile or not? Why? What problems did they encounter?
- Assign individual students to report on each of the following ways computers can be used in the home: tutor, entertainer, artistic expression, record keeper, word processor, analyst, manager, communications terminal, and as an aid to the physically handicapped. What equipment has been used to accom-

plish these tasks in the past? What are the advantages and disadvantages of using computers for these tasks?

- Invite a local businessperson to discuss and demonstrate computerized devices used to provide home security. How can computerized devices be used to protect the home from fire and burglary? How can computerized devices help reduce the energy consumption of a home? How long would it take to recover the cost of such devices through energy savings?
- Assign a student who is familiar with computers to demonstrate the proper use and care of the computer. How should software be used and cared for?
- Have students identify one specific problem in their home and develop a program involving improvement of home management skills to help solve the problem.

Housing, Home Furnishings, and Equipment

Today's smaller housing units provide a challenge to families trying to find space for a microcomputer. If predictions of increasing numbers of employees working at home using computer terminals come true, housing and furnishings will need to be designed to accommodate the computer equipment. Future housing may come equipped with two phone jacks, an electrical outlet, and an overhead light in potential computer locations. With computer wiring in two locations, the home is prepared for the two-computer family. While mom or dad is reading the electronic newspaper or booking on-line plane reservations, the children can play computer games, use educational software, or chat with on-line friends.

The most likely location choices for the home computer may include the recreation room for games, the kitchen for recipe storage and shopping reminders, a media room for multimedia uses and telebuying, and a home office, closetina, or spare bedroom for business transactions or hobby use. In the smallest bedroom, the hobbyist wishing to use the computer only occasionally can set it up in the closet and have a spare bedroom when the computer is not in use. Or the entrepreneur wishing to set up an electronic cottage can take off the closet doors and have a computer alcove within the home office.

In existing homes, whatever the choice of computer location, the computer will probably preempt space already claimed for other purposes. Well-designed computer furniture, rather than built-ins, may be the best solution for computer space in existing homes.

The following activities are designed to teach students about ways space for computers can be incorporated into the home and ways computers are being incorporated into home appliances:

- Invite an architect or kitchen designer to discuss the computer as a tool for residential design and ways space for computers is being incorporated into designs for new housing.

- Take a field trip to a store which sells computer furniture or have students collect pictures of computer furniture. Which alternatives would best fit with existing furniture? Which alternatives could be used in a closet? in the kitchen? in an office? How well-designed does each piece of computer furniture appear to be for its intended use? Use the pictures collected to design a bulletin board.
- Assign students to design a computer center for a specific family. Emphasis could be given to built-ins or to selection of computer furniture. Where should the computer center be located—kitchen, den, bedroom, or media room? What features are desirable for ease of use and safety?
- Take a field trip to an appliance store to see ways appliance designs and functions are changing as a result of computer technology. How is computer technology being used to save energy? to save labor? How beneficial are these features to the average family? How do these changes affect ease of operation? the knowledge needed for operation? appliance repair and maintenance?
- Have students collect information and articles describing new devices for electronically operating and protecting the home. How can such devices be used to control heating, cooling, hot water use, lighting and appliances, window treatments, etc.? How can electronic devices be used to protect the home against fire and theft? What are the costs of such devices? the potential savings?

Careers

Since most careers in the future will involve computer use, our curriculum should address computers as a job tool in home economics occupations. In addition, home economics teachers can help students think through the changes and challenges which may result from working in the electronic cottage of the future.

Significant numbers of persons working at home using computers create questions which must be answered. These questions include:

- Do people really *want* to work at home?
- How will women, who have only recently entered the labor force, feel about working at home?
- Will people be happy to work alone rather than in groups?
- Will employees who work at home lose out on communications and promotions at the office?
- Will workers who work at home via computers be doing little more than electronic piecework?
- What will be the effect of working at home on family transportation needs?
- What will be the effect of working at home on the family both mentally and socially?
- What happens when you can't call in sick?
- Will some people *ever* stop working if there is a computer in the home?

The following activities are designed to teach students about ways computers are used in various careers:

- Have students investigate the effects of computers on the workplace. What types of jobs have increased in number due to use of computers? What types of jobs have decreased? What implications does this information have for young people preparing to enter the job market?
- Assign students to investigate ways computers are used in various home economics careers. Examples include: controlling inventory in retailing establishments, facilitating work flow in apparel manufacturing, formulating food plans for restricted diets, and designing and producing furniture.
- Visit a fast food facility which uses POS (point-of-sale) terminals to control food and labor costs. Ask the manager to explain how POS terminals aid in cost control. How do the terminals aid in staffing and purchasing decisions.
- Tour a hotel or motel where a computer-assisted reservation system is used. Ask personnel to demonstrate use of the system. How is the system used to aid in keeping track of occupancy, clean rooms, staff, charges, etc.?
- Discuss potential savings which could be realized if a significant number of Americans worked at home via computer. How would the worker save? How would the employer save? What potential problems might occur in areas of motivation, management, supervision, communication, and group decision making? What problems might face the worker working at home?

FHA/HERO

The computer can even be a useful tool in FHA/HERO. The teacher can emphasize the futuristic nature of classes through FHA/HERO by using the computer. The computer can be used in recruitment, public relations, and fund raising. It can also be used by FHA/HERO members in maintaining membership lists, budgeting, maintaining club records, and recording club minutes.

The following activities are designed to teach students about ways computers can be used in recruitment, public relations, and fund raising:

- Have FHA/HERO members set up a display of computer software used in home economics classes. Title the display, "Preparing for your Future . . . In Home Economics." The display could be used as a recruitment tool in the spring to encourage students to enroll in home economics classes.
- Arrange for FHA/HERO members to demonstrate home economics computer software at a shopping mall or school open house. Examples might include: a dietary management program, a program identifying hidden sugar or sodium in foods, and a financial management package. [NOTE: When possible, select interactive software which allows the public to get involved. Software with color or graphics is usually more appealing than tutorial programs for this purpose.]

- For an FHA/HERO fund raising project, plan a computer fair emphasizing computers in education, business, and home. Charge for display space and for admission. Students might sell the following: copies of guidelines for selecting software for young children and for monitoring children's computer use, a list of software which could be used in the home, guidelines for purchasing a microcomputer, or suggestions for designing a place for the microcomputer in the home. These materials could be developed in class or as group assignments in child development, consumer education, and housing units. Demonstrations could be done by students using software such as a dietary analysis program, a financial management package, or a pattern selection program.
- Encourage FHA/HERO members to plan one or more programs involving presentations about computer applications at home or in home economics careers. The programs could involve a presentation, a demonstration, hands-on experience, a field-trip, or a combination of activities.
- Arrange for FHA/HERO members to interview a person who works at home using a computer. What types of careers offer this possibility? What problems does a person have to face in working at home using a computer?
- Plan FHA/HERO programs that will promote participation, raise funds, and prepare each FHA/HERO officer for his/her respective office.
- Prepare a poster that illustrates ways that a microcomputer can be used in planning and carrying out FHA/HERO activities.

SOFTWARE CURRENTLY AVAILABLE FOR HOME ECONOMICS CONCEPTS

CHILD DEVELOPMENT
- Calendar skills
- Colors
- Counting
- Drawing
- Educational drill and practice
- Games
- Identification
- Keyboarding
- Letters
- Music
- Reading
- Rhymes
- Shapes
- Social skills
- Sorting
- Stories
- Time

CLOTHING AND TEXTILES
- Color
- Design elements and principles
- Figure analysis
- Measuring for trims
- Metric conversion
- Pattern selection
- Pattern use
- Stain removal
- Textile care
- Textile design

CONSUMER EDUCATION
- Advertising techniques
- Banking
- Budgeting
- Buying a used car
- Checkbook balancing
- Comparative buying
- Computing gas mileage
- Consumer fraud
- Consumer law
- Consumer rights
- Credit use
- Figuring sales tax
- Financing a car
- Home insurance
- Interest
- Mileage/gasoline consumption

CONSUMER EDUCATION (continued)
- Money Management
- Reading an advertisement
- Understanding labels

FAMILY/INDIVIDUAL HEALTH
- Alcohol
- Diet menus
- Digestion
- Energy needs
- Exercise
- Food poisoning
- Health analysis
- Health hazards
- Health maintenance
- Home safety
- Life expectancy
- Nutrition
- Mental Health
- Poison

FAMILY LIVING AND PARENTHOOD
- Dealing with problems
- Friendships
- Mental health
- Sex roles
- Two-income lifestyle

FOOD AND NUTRITION
- Adjusting recipes
- Calories
- Cooking terms
- Daily nutritional requirements
- Dietary analysis
- Digestion
- Fast food
- Fat in the diet
- Food concepts
- Food cost analysis
- Food exchanges
- Food groups
- Food labeling
- Food poisoning
- Grocery lists
- Grocery shopping
- Hidden sugars in foods
- Meal service
- Measurements

FOOD AND NUTRITION (continued)
- Menu Planning
- Menu pricing
- Metric conversion
- Nutrients
- Place setting
- Preservation
- Principles of egg cookery
- Principles of quick bread cookery
- Principles of vegetable cookery
- Recipe abbreviations
- Recipe analysis and design
- Recipes
- Recommended dietary allowances
- Sanitation
- Snack foods
- Sodium
- Sugar
- Table manners
- Unit pricing

HOME MANAGEMENT
- Calendar
- Car maintenance records
- Checkbook
- Electrical use
- Energy monitoring
- Family records
- Financial records
- Home computer costs
- Home management ideas
- Home safety
- Household inventory
- Investment management
- Job jar
- List maker
- Mailing lists
- Problem solving/decision-making
- Recipes
- Shopping lists
- Tax planning
- Time management
- Word processing

HOUSING, HOME FURNISHINGS, AND EQUIPMENT
- Architectural design
- Drafting
- Energy audit
- Energy monitoring
- Energy saving
- Foliage houseplants
- Home design
- Home purchase analysis
- Mortgages
- Renting vs. buying
- Solar energy
- Utilities analysis

CAREERS
- Applications
- Basic job skills
- Career guidance
- Careers
- Earning with piecework or commission
- Entrepreneurship
- Figuring overtime
- Food service management
- Interviewing
- Job readiness
- Job survival
- Making change
- Management
- Marketing
- Part-time jobs
- Placement resources
- Profit and loss
- Record keeping
- Restaurant menu management
- Retailing
- Sales slips
- Self-concept
- Understanding the paycheck
- Working with time

FHA/HERO
- Budgeting
- Mailing lists
- Minutes
- Recordkeeping

Issues Related to Computers

Chapter 3

Home economics teachers are in a key position to help students and their families adapt to the rapid changes occurring in technology and the resulting effects on daily living. One way for home economics teachers to meet this challenge is to be aware of issues related to computers and their use. Among these issues are appraisals of consumer benefits, the effects of widespread computer use on individual privacy, the influence of the computer on human relationships, and potential health hazards associated with computer use. By addressing these issues, home economics teachers can contribute significantly to the way individuals and families deal with this new technology.

Computer Benefits

Families, unlike businesses, never knew they needed computers before advertisers began telling them so. As a result, some of the potential "needs" that require a microcomputer at home are trivial, impractical, oversold, or contrived by advertisers. Other needs are quite valid. Consumers are left to make choices about what will be useful for them.

Today's children have grown up with such siliconized gadgetry as *Little Professor* and *Speak and Spell*. Advertisers advise homemakers to trade in their recipe boxes for electronic ones. These same advertisers propose to change home recordkeeping into the model of efficiency via a computer financial management program.

How effectively consumers use the computer will depend on how well they understand its potential benefits and its implicit problems. A computer cannot educate our children unless the software is well-designed, motivating, carefully selected, and

wisely used. A computer may not be the best means of storing all types of information. It may not be appropriate to replace your recipe box, pocket calculator, pencil and ledger, or address book—all of which are relatively inexpensive compared to a costly microcomputer. It is unlikely that a computer program will turn a haphazard and inefficient recordkeeper into an organized and efficient one—not for long anyway. If the primary reason for purchasing a microcomputer is based on trivial or contrived needs, the home computer could be a novelty that goes the way of the CB radio, the hot dog cooker, and other short-lived fads.

To help consumers identify the potential benefits of a microcomputer, the following questions should be addressed:

- What are the implications of increased interaction with electronic devices on lifestyles, health, interpersonal relationships, and growth and development of individuals?
- What are the benefits to the individual and family of the financial and human investment required by a microcomputer?
- Will the computer literacy developed through owning and using a home computer provide paybacks in the future through increased employability and ability to adapt to and function in our increasingly information-oriented society?
- What is the opportunity cost of the time and effort involved in learning to use the computer? Just how expensive is it to learn to use the computer?
- Is the time involved in entering and revising data and in retrieving stored files from tape or disk really worth the cost or the effort?
- Will the indirect financial benefits of a computer—being able to keep track of investments and tax deductable expenses, to make more objective financial decisions (such as which car to purchase or which mortgage is best), to analyze energy expenditures, or to substitute computerized home entertainment for more costly away-from-home entertainment—help to offset some of the costs of owning and operating a computer?
- What are the alternatives to computer ownership?
- How can consumers provide input into what functions computers should serve, what role information systems should be filling, and what software packages should do?

Privacy

One of the advantages of computer use is being able to gather, store, or retrieve large quantities of information and to link information from several sources. But, therein also lies one of the most serious problems associated with computer technology. As we begin to shop, bank, and socialize from home computer consoles, we increase the risk of invasion of privacy and theft of personal information. Information which is taken out of context or combined from several sources may become inaccurate or distorted. As sophisticated technology has made it possible for our educational, medical, military, credit, and other histories to travel with us throughout our lives, Americans have become increasingly concerned about their individual privacy.

The extent of concern is indicated by the fact that, although the U.S. Constitution does not mention privacy as a right, Congress has enacted three major privacy statutes since 1971. These statutes are:

- *Fair Credit Reporting Act*. This act gives us the right to see our credit files and to challenge errors we may find. In addition, it gives us the right to know if any negative action is taken based on data in our files.
- *Education Privacy Act*. This act gives students and their parents access to school and college records.
- *Federal Privacy Act*. This act gives us access to personal files kept by the federal government and the right to correct errors in them.

As a result of federal and state statutes and court decisions in favor of individual privacy, several rights to privacy (*Miller*, 1982) have emerged:

- *Fiduciary duty to data subjects*. Every data collector now owes fiduciary duty, or trustee duty, to data subjects. The law recognizes that files contain information about human beings. If this information is misused, data collectors can be punished.
- *Limits on the information collected*. Certain kinds of information, such as religious and ideological data, should not be collected at all.
- *Right of access*. The right of individuals to see and correct information in their files is now considered a due-process right.
- *Right of confidentiality*. Those who control data systems now recognize their obligation to teach users the importance of privacy and confidentiality.
- *Right to expiration of information*. There is a growing consensus that data should be discarded when it is no longer timely or relevant.

Most of us would agree that the benefits of the computer are too great and computer usage already too well entrenched in our lives to avoid. However, we must recognize the importance of safeguarding the privacy of the information that computers obtain about us in order to reduce the potential that it could be misused.

Dehumanization and Isolation

Somewhat related to the problem of privacy is the charge that modern information technology tends to dehumanize people. Instead of being unique individuals, people are reduced to a collection of numbers—a social security number, a telephone number, a zip code, and a bankcard number. As used in reference to computers, being dehumanized is equated to being identified only as a number.

To make matters worse, decisions which were once made by people are now being made by cold, mechanical, impersonal devices. Every day computers make decisions about who gets

insurance, credit, employment, government benefits, and about other important matters. The decisions are not based on us as individuals, but on our computer files.

The potential for individuals and families to become isolated from the rest of the world increases as microcomputers move into more and more homes. Imagine what might happen if Toffler's "electronic cottage" (working at home via computer) becomes a reality. *Millions of co-workers* might never see one another. Instead of sharing the camaraderie of the workplace, they would perform their solitary duties via computer. In trying to work at home with household duties and family members competing for attention, will the worker be productive? If telebuying catches on, will the shopper miss the fun of dressing up and going shopping? Should children someday be educated at home by computer, will their socialization suffer? What will happen to family life and friendships if people increasingly rely on computers as sources of entertainment, information, and stimulation? If electronic media permits us to select only news and information of interest to us, will interests become increasingly fragmented?

In reality, the degree of isolation implied by these questions is unlikely. However, the possibility does cause one to think seriously about the potential impact of the microcomputer on our lives. John Naisbitt, author of *Megatrends*, projects a more positive view. He has said that as human beings develop more and more technology, which has the possibility of eliminating a certain level of human contact, people will intensify human contacts. He cites the recent increases in neighborhood organizations, special interest groups, and networks as examples of this process.

Copyright Laws

Still another issue associated with the increased use of microcomputers revolves around the illegal copying or "piracy" of copyrighted and copy protected software. Software is either copyrighted or is in the public domain. A **copyright** provides legal protection for the producers of commercially developed software designed to be sold at a profit. A copyright gives the producer the exclusive right to make copies of the software. Therefore, it is illegal to modify, to sell, or to make multiple copies of copyrighted software or its **documentation**. **Public domain** software, on the other hand, is that which was either developed with "public" funds or was contributed by its developer for free public use. Software that is in the public domain is available *free* and may be duplicated or modified by the user with no violation of the law. The only legal restrictions on the use of public domain software is that the user cannot attempt to sell it for a profit.

Copyright restrictions may be especially restrictive to school users. Copyright restrictions may prohibit the use of one disk

on multiple computers, as in a school computer lab. In addition, current copyright restrictions and seller imposed restrictions do not permit use of most software in **computer networks** (computer facilities with multiple computers sharing one mass storage device). These networks are being utilized in an increasing number of schools. Some vendors permit these uses under certain conditions, such as payment of a licensing fee or purchase of multiple copies.

Copyright law does permit the software user to make one backup copy of a program. Unfortunately, even this may be a problem. Many vendors do not provide a backup with the purchase of software. Even if provided, a backup copy is for archival purposes, not for use on another computer. Some vendors will provide a backup at additional cost or make a lease/purchase agreement with the purchaser. If no backup is available, the purchaser may not be able to make one easily if the program is copy protected. When a program is **copy protected**, copies cannot easily be made from the original disk or diskette because of mechanical or coding barriers built into the disk or the program.

These problems, compounded by the limited availability of preview or "on approval" access to software prior to purchase, contribute to the pirating of software. The result has been the development of "copylock picking" software designed to copy supposedly copyproof software. This does not alter the fact, however, that making copies of copyrighted and copy protected software is *illegal.*

Health Hazards

Concern has been expressed about potential health hazards associated with prolonged computer use. These potential hazards include radiation, eyestrain, backache and fatigue, heat and noise, and stress.

RADIATION

The computer itself produces no radiation. However, low levels of radiation are emitted from the screens of the videomonitors used with most computers. Because of their higher voltage, color monitors produce more radiation than black-and-white monitors. When color TV sets were first introduced, concern about radiation emissions prompted millions of parents to warn their children not to sit too close to the TV. Over the years, as TV picture tubes were improved, concern over radiation declined.

Now millions of people spend eight hours a day sitting less than two feet from computer monitors, yet we still know disturbingly little about the effects of such exposure over the years. There have been charges that long-term exposure can cause cataracts or birth defects, but these claims have not been clearly substantiated. The level of radiation emitted is so low as to be considered insignificant by most experts in science and industry. Even

so, some experts want to reduce allowable exposure levels to one-tenth what they are now. Still other experts disagree and feel low-level radiation may be even less hazardous than has been previously assumed. As a result, agreement cannot presently be reached on a threshold level below which radiation has absolutely no effect. Computer users should be aware of the questions about safety that remain unanswered. Microwave ovens and videomonitors should be serviced and checked at least once a year for possible leaks to minimize the risk of increased radiation exposure.

One concern is the tremendous increase in the number and use of computers in schools. At present few students spend even an hour a day at a computer. However, if predictions are correct, they will one day be spending significant portions of the school day, from elementary school through college, with computers. This represents a potentially large increase in the number of persons receiving long-term exposure to low levels of radiation.

One writer (Klitzner, 1981) estimated that the amount of radiation a child might receive from sitting about a foot from a color monitor an average of an hour a day for a year is only one sixty-eighth as much as the amount of radiation received from a single X-ray. Another comparison: the maximum radiation received by the hypothetical child would be 3.65 millirems per year (0.01 per day). The allowable exposure for radiation for technicians is 5000 millirems a year. The average American receives 100 millirems a year from natural sources—cosmic radiation, internal radiation (from our own bodies), and radiation from soil and rock. Obviously the radiation one gets from the computer monitor is very slight compared with the amount received from other sources.

Computer manufacturers are developing new ideas to alleviate radiation problems. Still, it wouldn't be a bad idea for users to sit as far away from the monitor as practical. In addition, buying the safest possible monitors should always be a top priority.

EYESTRAIN

Eye problems (eyestrain, headaches, and blurred vision) are probably the most common complaints among frequent computer users. Surveys of computer users report sore, red, stinging eyes; dull headaches; and occasional blurred vision. While permanent eye damage may not be a threat, efforts should be made to avoid these problems. The primary causes of the eye problems are related to the sharpness of the image on the monitor screen and glare in the work area.

Careful selection of the videomonitor can eliminate some of the eyestrain problems. Screens with sharp images reduce the difficulty of reading. This may mean selecting a computer of higher resolution or buying a monitor instead of a TV set; the monitor signal is less degraded and the image is clearer. A dark green screen with lighter green or yellow characters, or a black screen

with white letters are the preferred combinations for preventing eyestrain. Filter panels can cut glare and reflection, but they may also cut down on the brightness and resolution of the screen. Some screens come treated with "anti-reflection" shielding, which can be helpful. Monitors with tilting screens can be adjusted to reduce glare, but not all brands offer this feature. Small screens may display characters which are too small for easy viewing. Larger screens with a viewing distance of two feet and a character height of at least three-tenths of an inch are recommended. The viewing distance can be adjusted if the screen is not attached to the keyboard. The matrix of dots which form each character should be seven dots wide by nine dots high to ensure sharp easy-to-read characters.

Placement of the microcomputer is another factor in reducing eyestrain. Placing the microcomputer at right angles to windows will help eliminate glare. Window shades are a better choice than Venetian blinds because the striped pattern across the screen is distracting. Indirect lighting also makes the screen easier to read. Lowering the level of overhead lighting reduces glare from the screen and the contrast between the darker screen and the rest of the area. In addition, computers should never be placed where the screens face one another, since one screen can reflect off the other. Less obvious sources of glare may include bright walls, shiny desk tops, the microcomputer paper, untextured keyboard keys, chrome fixtures, bright fixtures, or white clothing. A neutral color scheme is best.

Careful adjustment and maintenance of the monitor can help prevent eyestrain. If the image appears to flicker noticeably, lower the screen's brightness while maintaining the contrast. A control which allows the user to adjust the brightness should be a consideration in selecting a monitor. Twice-a-year maintenance will prevent much of the blurriness which can appear on monitors.

Finally, users should be taught to take periodic breaks to allow their eyes to readjust. The time required to recover from blurred vision varies from 15-45 minutes depending on the age of the user. To prevent eyestrain, users should take a 15-minute break from the computer at least every two hours. In schools, it may be wise to provide a 10-minute rest break per hour if students are working for long periods at computers using word processing systems. Persons who use computers regularly for long hours should also have regular eye exams.

BACKACHE AND FATIGUE

A good chair is essential for preventing backache and fatigue while using the microcomputer. The chair should be adjustable in height, have an adjustable backrest to support the lower back, and swivel from side to side. Ideally, the chair would also have five casters instead of four to prevent tipping. Fatigue may also be caused by poor posture. Poor posture may result from a chair which needs adjusting in height. It may also be caused by

the monitor being at the wrong height, angle, or distance. A separate monitor with a tilting screen can be adjusted to the variety of users which any school machine might have. Another cause of fatigue is spending long hours at the computer terminal.

HEAT AND NOISE

Heat is a fairly minor problem with computers. Although computers create more heat than typewriters, it is usually not a problem unless several computers are arranged close together or persons are sitting with their backs to a computer behind them. Air conditioning is the obvious solution.

Although computers are relatively quiet, printers can be quite loud, especially if more than one printer is used in the same room. A printer cover is an inexpensive solution that will protect users and others working nearby from excessive noise.

STRESS

Persons whose work requires computer use can become the victims of stress if the job requires rigid work procedures, constant pressure for performance, little control over job tasks, and little satisfaction from the end product. One worker's performance is sometimes pitted against the others, creating a feeling of being watched and controlled by the computer. Stress is the result. The issues related to computer use can be addressed in every home economics subject area. By squarely facing the issues, presenting up-to-date information, and encouraging discussion of all sides of the issues, teachers can help students become better prepared to deal with computers and the impact of computers on their lives.

Part II
Computer Hardware–
Selecting, Using, and Maintaining

The Microcomputer System

Chapter 4

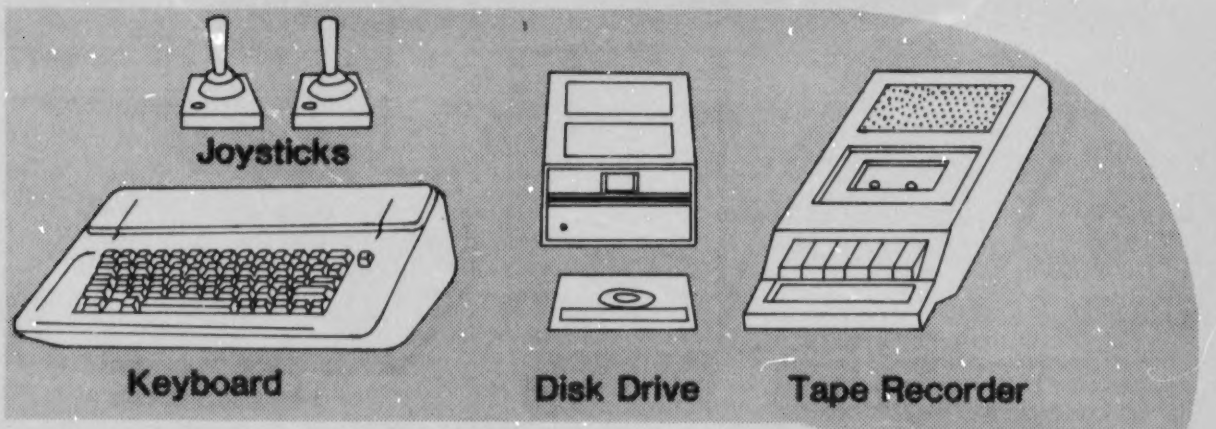
A **computer**, quite simply, is a machine that can receive, store, manipulate, and retrieve information. The computer uses sets of instructions, or **programs**, based on arithmetic and logic to process information. A **microcomputer** is the smallest version of a computer both in size and capacity. Microcomputers may be used in conjunction with other devices or components, which may or may not be housed in the same cabinet.

Computer Components

A **microcomputer system** is put together from four separate components, similar to the way a stereo component system is put together. The physical components of a computer system (all the parts that are "hard") are called **hardware**. These components include the following:

- **Central Processing Unit (CPU)** –the unit containing the microprocessor (the tiny "brain" of the computer which performs and controls the work the computer does).
- **Memory**–the chips which store information used by the computer either temporarily or permanently. The memory chips are usually located near the CPU.
- **Input devices**–devices which allow you to communicate with the computer. A keyboard is the most common input device.
- **Output devices**–devices which allow the computer to communicate with you. A television monitor or display terminal is the most common output device.
- **Storage**–devices which store computer information. Floppy disks (or diskettes) are used to record (or store) information from the computer, and also feed the computer its programs (software).

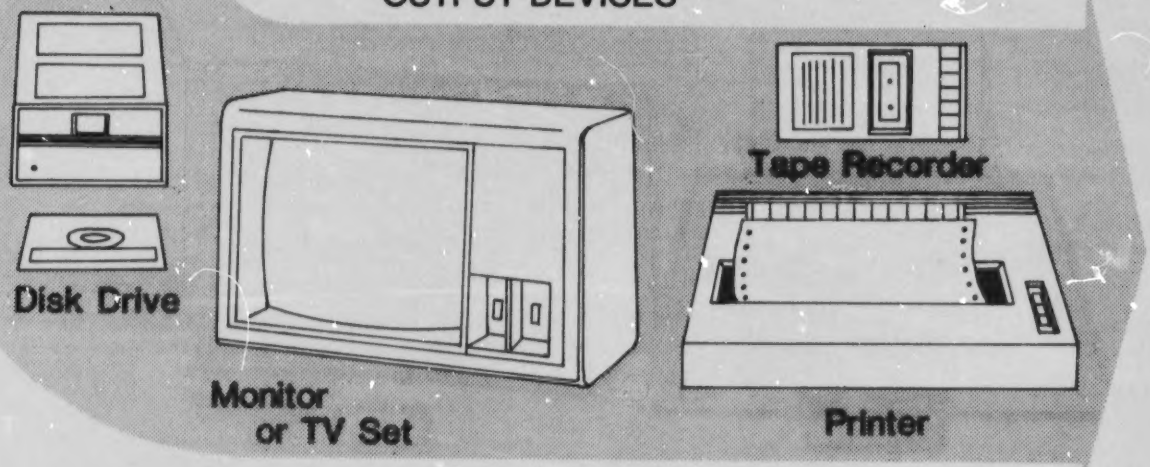
The Hardware Components



INPUT DEVICES

Central Processing Unit

OUTPUT DEVICES



STORAGE
DEVICES

Some components of a microcomputer system are illustrated on the previous page. These devices may be housed together in one unit or separately.

Steps in Selecting a Computer System

The process of buying a microcomputer system is similar to that of making any other major purchase. However, because a microcomputer can be used for many purposes—games, education, recordkeeping, programming—its selection requires careful planning and consideration. Also different brands and models have different features and perform some tasks better than others. To complicate matters further, software that fits one machine probably will not work on another. The steps that follow will help you find the right system for your needs.

STEP 1. IDENTIFY USES

What will be your major uses of a computer? Do you plan to use the computer for teaching content, testing, classroom management, or other applications? Do you plan for students to use the computer for drill and practice, as a tutor, for discovery learning, for problem resolution, or other applications? It will be easier to select computer components to meet your needs once you have identified the uses you will make of a computer. If you want to learn more about computer applications in home economics, see Chapter 2.

STEP 2. CONSIDER SOFTWARE NEEDS

What software is available that you could use in your teaching? Remember that software developed for one brand of computer usually will not work on another brand of computer and may not even work on two models of the same brand. The description of software usually indicates the brand(s) and model(s) of computer(s) for which it is available. It may also tell you what computer features and additional equipment are required. This information will help you identify computer brands and features to meet your needs. Some brands have more software available than others. Some may have a lot of software available, but little that would be of interest to you. Information on software is provided in Chapter 13.

If you plan to write your own programs, decide what language(s) you would like to use. Then be sure the computers you consider speak the language(s). Most microcomputers can be programmed in BASIC. Some can also be programmed in PILOT and Logo, which are also popular in educational settings. If you don't already know how to program, but would like to know, be sure the computers you consider purchasing have clear, easy-to-understand teaching aids to help you learn. Information on programming languages is included in Chapter 8.

STEP 3. SELECT HARDWARE

Based on your search for software, can you now identify one or more brands of microcomputers which would meet your needs?

As you shop, ask the following questions about each: What are your minimum requirements and preferred features? Is the computer flexible enough to meet all of your current and anticipated needs? Can additional components be added to the system in the future? Are other teachers in your school district or region using the brands and models in which you are interested? Do other teachers use software that you would like to use? Is the brand available from a local dealer? How hard will it be to learn to use the computer? Does the computer look attractive, functional, and approachable? Does it use color coding to identify key functions? Is the reset key located away from other keys where it cannot be easily pressed accidentally? Can several computers be connected together (called **networking**) to share programs and expensive peripherals such as disk drives and printers to reduce the cost of computer equipment? What kind of input options are available? What kind of output options are available? Can the system easily be damaged by or injurious to students? Detailed information on selecting basic computer components and peripherals is included in Chapters 5 and 6.

STEP 4. CHECK SERVICE

Which computer brand has the best record for repair-free service? Is service and support available locally for the brands in which you are interested? How long has the dealer been in business? Does the dealer maintain a service department? What type of warranty is offered? Are installation services provided? Can repairs be made promptly? Will the dealer loan you a similar system until yours is fixed? What training, inservice programs, or self-teaching materials are provided? Is there a charge for training? Availability of service becomes even more important the farther removed you are from a population center that has computer dealers and repair stores.

STEP 5. DETERMINE COST

How much money is available now for the purchase of computer equipment? If sufficient funds are not currently available, what are other possible sources of funds? Local education funds, state or federal funds, PTA appropriations, assistance from civic organizations, student organization fund raisers, and donations are all possibilities. Even if computer equipment is donated to the school, it should meet the same criteria as purchased equipment and be compatible with existing equipment. Is a lease-purchase plan available? Is an educational discount available? How much will peripherals, software, and supplies add to the cost? Is money for these items included in the budget or likely to be in the future? How much money should be budgeted for future computing expenses (including care and repair)? Be aware that the basic computer system is likely to be only the beginning of your computing expenses.

STEP 6. SHOP AROUND

Now you are ready to shop for your computer. You may want to start by reading reviews of computers in journals and magazines. Arrange for local stores and computer suppliers to

demonstrate their systems. Visit local computer club meetings. Get acquainted with other teachers who are already using computers in their classes. Browse at retail computer outlets. Attend educational conventions that have computer displays. Finally, try out each computer in your final selection group before you buy. While you are shopping around, you will also be learning where you can purchase your computer system. Your choice will probably be a local retail store or a mail order supplier. If you are considering a computer that is supposed to be serviced by the retailer, a local store with a reliable repair department is a good choice. In many cases local dealers will match or beat mail order discounts on educational bids. Some companies will sell quantity educational orders direct without going through dealers. However, if discounts and repairs are not available locally or through a company, a reliable mail order supplier may be an equally good choice. In any case, be sure to check the dealer's or company's reputation before you place your order.

STEP 7. BUY IT

Now it is time to make your final selection. Request bids and complete your purchase order as dictated by local school district procedures.

Selecting Computer Components

Chapter 5

A basic computer system may be as simple as a CPU-keyboard unit, a cassette player, and your own TV set. A more versatile system for educational use should include a CPU-keyboard unit, monitor, and a disk drive. Let's look at what each of these components does and the considerations you should make when selecting them.

Central Processing Unit

The **Central Processing Unit (CPU)** houses the "brain" of the computer, the **microprocessor**. The microprocessor is the "real" computer in any microcomputer system. It consists of thousands of tiny electrical circuits which have been arranged on a slice or **chip** of silicon only 1/4 inch square encased in a rectangle of nonconductive material.

The Central Processing Unit is tied to the computer's memory chips. The computer is capable of remembering some things permanently, while others are remembered only temporarily.

READ ONLY MEMORY (ROM)

The permanent type of memory is **Read Only Memory (ROM)**. ROM is similar to the brain's innate intelligence. Some computers have more innate intelligence than others. Some computer manufacturers, for example, provide ROM with only enough intelligence to do a few simple tasks, such as tell you to load a program into the machine. Some provide ROM with enough intelligence to "understand" a programming language so that you can write your own programs or copy a program from a book or magazine. Other manufacturers sell much of their software in ROM. The user cannot ordinarily change what is in ROM.

RANDOM ACCESS MEMORY (RAM)

Some information is needed only temporarily by the central processing unit. Such data or instructions can be placed in the computer's temporary memory (**Random Access Memory, or RAM**), used, then replaced with something else. The biggest problem with RAM is the fact that in many computers everything in RAM is "forgotten" when the machine is turned off. If you need to save something in RAM for later use, you must store it on tape or on a disk before the computer is turned off. Some units now have battery power which allows RAM information to remain intact even when the power is turned off.

Information which will be used later by the microprocessor is stored as electrical charges in RAM's memory "cells." Each "cell" is a tiny space on a silicon chip that can be charged by an electrical impulse. A computer can store only one "bit" of information in each memory cell. A **bit** can be either a 1 (one, on) or a 0 (zero, off). Generally a cell that has an electrical charge in it is considered a "1" while a cell with no charge is a "0." Because this system uses only two digits, the 1 and 0, it is called a **binary system**.

By themselves bits are not very useful. To make them more useful eight of them are combined to create a code for a single character called a **byte**. A bit looks like this–0–while a byte looks like this–00110011. A bit has limited usefulness because it can only be a 1 or 0, but a byte can be any of 256 possible combinations of 1s and 0s. The memory of most microcomputers is organized into "eight-bit bytes." The computer is programmed to recognize each eight-bit pattern as a code which stands for a letter, number, or instruction. While a computer can't read the letter "A," it can "understand" a byte (a pattern of eight bits) which stands for the letter A. The most commonly used code today is **American Standard Code for Information Interchange (ASCII)**.

The size of the computer's memory is measured in **kilobytes (K)** or thousands of bytes. One byte is what it takes to store a single character (one eight-bit byte) in memory. One kilobyte (1K) of memory could contain 1024 characters of binary information or about one-half page of double-spaced typewritten copy.

The amount of memory in RAM defines the computer's maximum capacity to receive information and process it efficiently. A 16K computer can hold 16,000 units of information in its memory. That means a typical 16K computer can store about eight letter-size pages. For word processing and more complicated programs, 32K to 48K of memory is desirable. That much memory would hold 16 or 24 pages of information. The amount of RAM actually available to the user is usually less than its stated capacity. The amount of RAM available to the user differs among machines because manufacturers make different decisions about how much of the necessary "housekeeping" program should be permanently supplied in ROM (Read Only

Memory) and how much should be loaded with a programming package. Microcomputers generally come with from 16K to 256K of memory. In many microcomputers, RAM is expandable, either through plug-in chips, plug-in circuit boards, or plug-in cartridges. Some systems can be expanded up to 256K.

Inside the computer, all of the chips (microprocessor, ROM, and RAM) plug into a plastic circuit board called a **motherboard**, which provides an interconnecting network for them. To be useful, information must be transferred out of the computer for display, storage, or control. This transfer is called **output**. To make output possible, electronic connections are provided so that you can connect computer **peripherals** (or accessories) to the CPU.

Input/Output Ports

Input/output ports, or **I/O ports**, provide entryways into the computer through which data may flow into or out of the computer. These connections can be attached to devices such as a cassette recorder, a disk drive, a videomonitor, or a printer. The ports may be specialized, attaching only to a video display or cassette recorder, or general purpose, attaching to any of a variety of accessories.

To connect a peripheral to the computer, it is first connected to a wire or cable. This cable is plugged into an interface board which is in turn plugged into the computer's I/O port. An **interface board** is a card with some ROM (Read Only Memory) chips on it. These ROM chips contain some permanent instructions so they can tell the peripheral when to turn on and off, etc.

There are two types of I/O ports—parallel and serial. A **parallel I/O port** has a wire or connection for each of the eight bits in a byte of data. This allows the computer to send one character of information out of the computer at a time by sending one bit of the code over each of eight different wires. Parallel ports are usually used to connect the keyboard and the printer to the computer. A **serial I/O port** sends one bit of the eight-bit code at a time, one after the other, over a single wire to the peripheral. Information sent back and forth between two computers over a telephone line is sent through a serial I/O port.

The term **baud rate** is often used in reference to I/O ports. It refers to the speed with which information can be sent through the I/O port. A baud rate of 300 is equivalent to a speed of around 350 words per minute. To work together, the baud rate of a computer must match the baud rate of any accessory, such as a printer or telephone modem, to be used with it.

Some computers come with standard I/O ports for plugging in peripherals. Others require an expensive interface device or must use the manufacturer's nonstandard peripherals.

Questions to Ask About Central Processing Units

The following questions should be useful in evaluating Central Processing Units:

- How much memory is included in the CPU's Read Only Memory (ROM)?
- Does ROM include a programming language? If so, which one?
- What is the size of the computer's Random Access Memory (RAM)?
- How much memory can be added to RAM?
- How many and what types of I/O ports are provided?
- Are the I/O ports standard or non-standard?

Keyboard

Most microcomputers have a standard typewriter-style keyboard attached to the CPU unit. A few, however, have a plastic membrane with characters that look and feel like the controls on some microwave ovens. The membrane is sensitive to touch. While this type keyboard is not appropriate for touch typing as in word processing, it may be useful for computerized cash registers which might be exposed to food or beverage spills in a food service facility or for very young children who might damage the computer with sticky fingers or spills. Some computer keyboards come with small keys like those on calculators which are undesirable for most serious applications. The full-sized standard typewriter-style keyboard is best for most purposes.

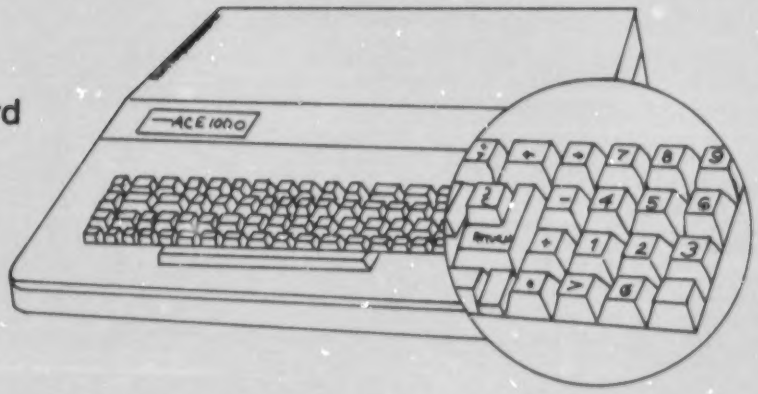
A good keyboard with smooth resistance to touch is essential for touch typing. Keys should neither catch nor bounce when struck. A catching key may result in skipped letters when typing, while **keybounce** will result in repeated letters, like "aaa" when the letter "a" is struck.

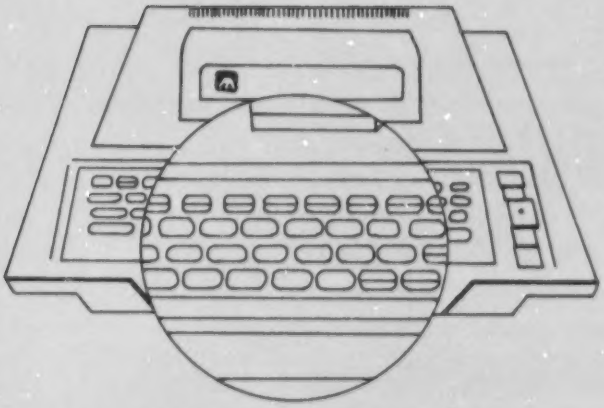
Computers differ not only in the type of keyboard but also in the number and usefulness of the keys. The number of keys may vary from 40 to more than 100. In addition to the keys normally found on a typewriter, an elaborate computer may have **special function keys**. These are keys which either the computer or you may dedicate to a special purpose. It may also have extra keys that form a **numeric keypad** (number keys arranged like a 10-key adding machine or calculator). The numeric keypad is helpful in business applications, where numbers are entered more often than in typical home use. See the following page for illustrations of various types of keyboards.

Questions to Ask About Keyboards

The following questions should be useful in evaluating keyboards:

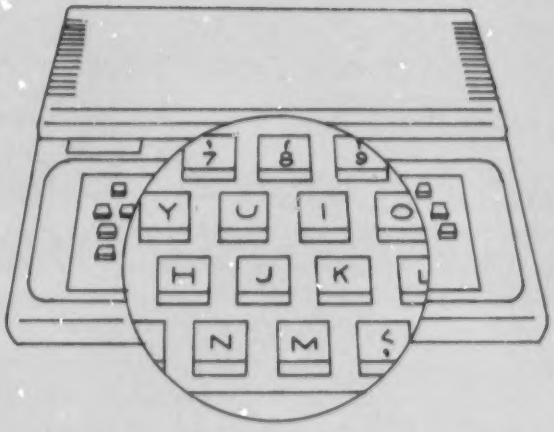
Typewriter-Style Keyboard

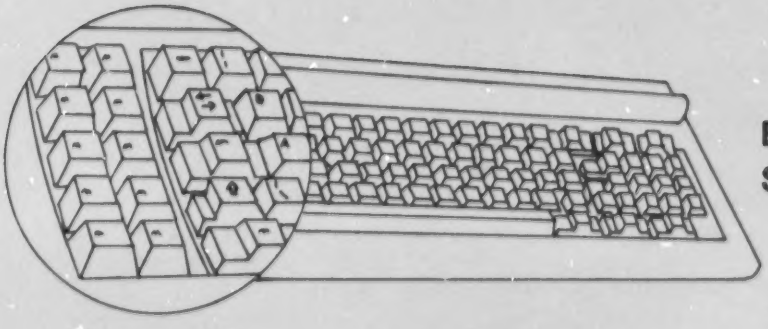




Membrane Keyboard

Calculator-Style Keyboard





Elaborate Typewriter-Style Keyboard

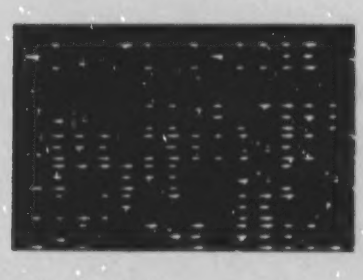
○	• Does the microcomputer have a standard typewriter-style, plastic membrane, or small-key keyboard? • Does the keyboard have smooth resistance to touch? • Do the keys catch or bounce when struck?	○
○	• How many keys are provided? • How many of the keys are special-function keys? • Does the keyboard include a numeric keypad?	○
○	• If the keyboard is to be used for word processing, are cursor control arrow keys provided?	○

Video Display

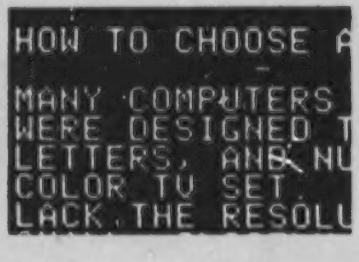
The base price for most microcomputers does not include a display terminal (**monitor**). Some microcomputers have a built-in black and white monitor. A computer may or may not be capable of generating color images.

TELEVISION SET

Some computers are designed to attach to your own TV set, but a TV set is not an ideal display. The first drawback of a television set is its limited resolution, or degree of sharpness. As illustrated below, the image displayed on a TV screen is not as sharp as the same image displayed on a computer monitor. This may not be a problem if the computer is used mostly to play games, but the fuzziness of the characters displayed on a TV set leads quickly to eyestrain if the computer is used for hours at a time or for word processing or programming. Graphics detail is also greatly enhanced by a monitor.



TV Set



Monitor

The TV screen's second drawback is the number of characters (or **columns**) it can display per line. The maximum number of columns which can be displayed legibly on a TV screen is 40 characters. This is about half the number of letters per line on a normal typed page.

In the home, a third drawback involves sharing the TV set with the computer. Since the TV set can only be used for one purpose or the other, the family may find it inconvenient to schedule its use for both TV viewing and for computer use. The main advantage of using a TV set for the computer's video display is being able to reproduce color without the cost of a color monitor. However, an inexpensive **color monitor**, which is essentially

a television set without a tuner to receive broadcast signals, may be a good alternative. Its resolution, though less than ideal, is still adequate for a computer intended for use with a television set. In addition, it would provide the color graphics necessary for games and educational programs frequently used by families. More expensive color monitors provide sharper images than less expensive composite videomonitors.

VIDEOMONITORS

A monitor, rather than a TV set, is necessary for serious microcomputer applications. Two basic types of monitors are available—monochrome and color. **Black and white monitors** display white letters on a black background. **Amber monitors** display amber text on a black background. **Green phosphorous monitors** display green letters on a black screen. **Color monitors** display 4 to 16 different colors. The **RGB** (red-green-blue) **monitors** produce the greatest sharpness of color monitors, approaching that of monochrome monitors. RGB monitors are the most expensive of the color monitors. **Composite monitors** are less expensive, lower quality color monitors. Typical monitors have a screen that measures 9 to 13 inches diagonally.

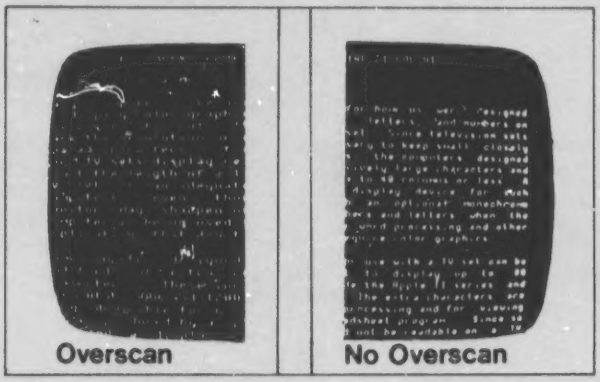
The number of characters the computer can display horizontally on each line ranges from 20 to 80, but 40 or 64 is typical. Eighty is desirable for word processing. The number of lines or rows displayed from the top of the screen to the bottom ranges from 12 to 32, with 16 or 24 being typical. A shallow display of 16 lines is inconvenient for some applications such as word processing or writing programs. Most computers display both upper- and lower-case characters. This is particularly desirable for word processing. Some computers display capital letters only.

Questions to Ask About Videomonitors

As you compare different monitors, you should find the following questions useful:

- What is the diagonal measurement of the screen?
- How many characters are displayed on each line?
- How many lines are displayed at once on the screen?
- What color are the letters and the background?
- Will the system display both upper- and lower-case letters?
- Is the display in focus even at the edges?
- Are the characters on the screen bright enough to be seen even in a brightly lit room?
- Is the contrast between the characters on the screen and the background sufficient to make the screen easy to read?
- Does every character have uniform width regardless of its position on the screen?
- When you view the screen head-on, do the display's edges appear vertical? (A slight outward curvature, called **barrel distortion**, is acceptable.)

- Is there evidence of overscan? (Overscan is a condition in which the image overflows the screen's edges, meaning the loss of some text at either side of a full screen. Overscan is necessary in a monitor selected for use with a computer designed for use with a TV set, but not in computers of different design. Overscan is illustrated below.)
- Does the monitor have an antiglare screen to reduce glare from lights, windows, and other sources?
- What controls does the monitor have and are they conveniently located?
- How much does it cost?



Overscan | No Overscan

Cassette Recorders and Disk Drives

The computer has memory inside which is either permanent and cannot be changed or temporary and forgotten when the computer is turned off. To save the programs you write or the results of programs you use, you need external memory storage devices, such as tapes and disks.

In addition to storing information *from* the computer, programs are available on tapes and disks. Therefore, cassette recorders and disk drives are input, output, and storage devices all in one.

CASSETTE RECORDERS

Cassette recorders are cheap, usually unreliable, and hard to use. Some computers will work with any portable cassette recorder. Others require the cassette recorder sold for that computer. Cassette recorders are quite adequate for some home users. The **cassette tapes** used with microcomputers are basically the same audiocassette tapes used for recording and playing music. Programs or data you want to save and use again later can be recorded from the computer's internal memory onto audiocassette tapes. The main disadvantage of tapes is the time it takes to transfer the contents of the tape into the computer's internal memory. A large program can take as long as three minutes or more to load. Retrieving information using a cassette recorder is much slower and less convenient than when using a disk drive. The risk of accidently erasing information is much greater too.

BEST COPY AVAILABLE

DISK DRIVES

Almost all microcomputers can store programs and information on magnetic **disks** (circular, record-shaped devices permanently housed in square envelopes). The disk slides into a slot in a **disk drive**, the hardware device which operates the disk. The disk drive spins the disk and reads or places information on the magenetic surface of the disk.

The most popular type disk drive uses a flexible 5 1/4 inch **floppy disk** (also called "diskette" or "minidisk"). Other disk drives use 8-inch disks. Some disk drives use **hard disks** rather than flexible ones.

A disk drive can locate, read, and store information very quickly. It can find information on the disk in only a fraction of a second. The same information would take several minutes to find on a cassette tape. The main disadvantage of disk drives is their cost. A 5 1/4 inch disk will store 90K to 360K. Some go much higher now–650K or more.

For many applications a single disk drive is sufficient. For some applications, such as word processing, two disk drives are more convenient. Two disk drives are also more convenient than a single disk drive when copying programs and making backup files of important data. While these tasks can be accomplished with one disk drive, with two the necessity of constantly switching disks to accomplish operations is eliminated. With only one disk drive, to use some programs you have to insert the program disk, load it into the computer's memory, then replace the program disk with a fresh blank disk to store information and data resulting from using the program. With two disk drives, the program disk would be inserted in one disk drive and the data storage disk in the other.

To use a disk, a computer needs not only a disk drive but a group of programs called a **disk operating system**. The disk operating system is sometimes stored in a computer's permanent memory. Sometimes the operating system is written on the same disk as the software program itself and loaded temporarily into the computer's memory along with the software program. Sometimes the operating system is on a separate disk.

Most brands of computers are designed to run only programs written for their own disk operating system. Some computers can also use multiple operating systems. A program written for one operating system will not run on another. In addition, due to hardware incompatibilities, a program written for the operating system of one brand of computer will not run on another brand computer with the **same** operating system.

Disk operating systems differ from one another in several ways. First, they differ in the number and quality of applications programs (software) available. Second, some disk operating systems perform their operations faster than others. Finally, they differ

in their degree of "user friendliness" (the amount of onscreen help they provide an inexperienced user).

Questions to Ask About Cassette Recorders and Disk Drives

When selecting a cassette recorder or disk drive for use with your microcomputer, consider the following points:

- Is the external storage device compatible with your computer and/or disk operating system?
- How much information can be stored?
- How much software is available that is compatible with your computer and this storage device?
- How reliable is the storage device?
- How much time does it take to load?
- How long does it take to locate information?
- How easy is the device to use?
- How much does the external storage device cost?
- How much will supplies cost?

Expanding the Computer System

Chapter 6

Few persons are satisfied with their basic computer system for long. Most soon begin making plans to expand their basic system to perform additional tasks. A printer is among the first options or **peripherals** added to most systems.

Printer

A printer is an important addition to the computer system for many applications, especially word processing and program writing. For word processing, a printer is necessary for printing out the resulting copy. For program writing, a printer is needed to print out parts of the program before the whole program is finished and for checking the completed program for errors. It is also useful for printing out inventories, financial records, and files of books, recordings, or recipes that you may have put on disk or tape.

COMPATIBILITY

When selecting a printer, your first concern will be that it be compatible with the computer. To work together, both the computer and the printer must have the same type **interface** or connection (parallel or serial) plus matching **baud rates**. It is also important to check that software is compatible.

Every printer will not work with every microcomputer and all software. Check with the dealer or manufacturer before buying to determine whether or not a particular printer is compatible with your microcomputer and software. Also find out if additional costs will be necessary for the elements to work together.

TYPE FORMATION

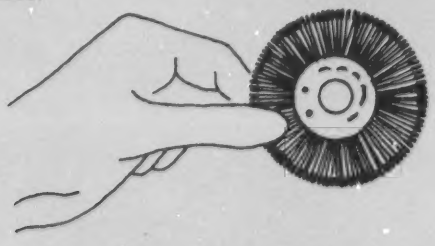
Printers may be classified by the way they print: thermal, dot matrix, jet ink, or fully formed character. Each of these classifications is discussed on the following page.

Thermal printers produce letters on special paper. These printers produce an image on a special oxide-treated paper. Their operation is so quiet that they are sometimes called silent printers. Thermal printers themselves are inexpensive, but the paper they use is expensive. However, a new type of thermal printer is available that works on plain paper.

Dot matrix printers are probably the most common kind of printer in schools today. These printers form letters by printing dots within a rectangular area. **Draft quality** dot matrix printers use fewer dots, usually 5 dots wide by 7 dots high, than **correspondence quality** printers. Printers which produce correspondence quality print usually use a matrix of 7 x 9 dots. In general, the more dots the better. However, some printers reach this quality by making two or more passes to form the characters. Some even offset the patterns of dots slightly to eliminate the space between the dots and create more fully formed characters. Most dot matrix printers are quite versatile. Most have graphics capability. Many can print a variety of type faces—condensed, extended, bold, larger, or smaller. A few even permit the user to create a new typeface. Many can print subscripted and superscripted letters or numbers such as H_2O and 10^5. Some are able to print in two colors (usually black and red). A few print in multicolors. Dot matrix printers are fast, inexpensive to operate, and quite adequate for many purposes. A wide range of prices and features are available. Their main problem is that the resulting print "looks like letters formed by dots."

Jet ink printers are the newest type of printer. They make fully formed characters by spraying ink on the paper through a tiny ink jet. Jet ink printers are extremely fast, produce high quality print, and are rather expensive.

Formed character printers work by striking the type against a ribbon to produce letters on the paper the same way a typewriter does. The result is copy that closely resembles that produced by a high quality typewriter. The most common formed character printer is the "daisy wheel" printer, so called because the characters are arranged around a molded plastic disk, like the petals of a daisy. A daisy wheel is illustrated below. Daisy wheel printers are available with a choice of print styles and sizes. Changing the wheel gives you a different letter style or size. Daisy wheel printers are essential for many business uses, but they are much slower than other types of printers. Most daisy wheel printers are very costly for typical home and school uses.



TYPE CHARACTERISTICS

The way the characters are designed and spaced affects the appearance of the copy. Points to check are discussed below.

Type Styles. Most dot matrix printers offer variations from the way they normally print. The printer may compress the type, expand it, or change its height and width. Some include bold face and italic type. Daisy wheel printers offer a choice of wheels with different type styles.

Proportional Spacing. A printer with **proportional spacing** provides more space for a "W," for example, than for an "i." This makes the print look similar to that in books and magazines.

True Descenders. Some printers raise the lower part of some lower-case letters, such a "g" and "j," to the level of the printed line. Without **"true descenders,"** the print is hard to read. You may wish to choose a printer that uses true descenders.

Subscripts, Superscripts, and Special Characters. Not all printers include **subscripts**, as in H_2O, or **superscripts**, as in X^2, or other special characters, such as chemistry or foreign language symbols. You may not need these features, but check to make sure the printer you choose has the characters you need.

GRAPHICS

Some printers can draw lines, graphs, shapes, or pictures generated by the computer. A printer with **dot-addressable graphics** can "draw" very sophisticated pictures consisting of many tiny dots. **Block-addressable graphics** are less versatile. Printers with this type of graphics can control only blocks of dots, so the results are cruder and less precise than with dot-addressable graphics.

SPEED

Printer speed is important if you plan to print a large volume of copies or graphics. Printer speed is measured in **characters per second** (CPS) and all printers are given a CPS rating by their manufacturers. Dot matrix printers operate at high speeds of from 50 to more than 200 CPS. Formed character printers are slower at 12-55 CPS or more. Faster speed usually indicates lower quality printing.

All printers print as fast or faster than a good typist can type. Because computers are faster than printers, however, printer manufacturers build **buffers** into the printer to store characters until the printer can process them. Buffers may hold as little as a single line of type to more than 4K of characters. Buffers can be expanded or added to most printers at additional cost.

Most manufacturers have increased the speed of their more sophisticated computers through special designs. A **bidirectional printer** can print continuously right to left, then left to right, thereby avoiding the time "wasted" in a carriage return. A

smart or **logic seeking printer** automatically moves to the next printing point without spacing there space by space. Smart printers are especially useful for printing tables and other materials with complex formats.

PAPER

Printers vary in the type and width of paper they use and in how they feed the paper through the printer. Thermal printers use a special oxide-treated paper. They cannot use regular paper. Thermal paper is relatively high in cost.

Some printers use regular paper, one 8 1/2 x 11 inch sheet at a time, just as a standard typewriter does. The sheets have to be fed individually if a special automatic feed attachment is not available. Single-sheet printing is desirable for letters, since you can use letterhead stationery.

Some printers use a continuous sheet of paper. One type of continuous paper, called **teletype paper**, come in rolls. It works well for lengthy lists or programs. Another kind of continuous paper is **fanfold, tractor feed, or sprocket paper**. This type paper has a perforated strip of holes along the left and right edges. It is also perforated into sheets, allowing the paper to fold fan-like without stopping at the end of each page. The paper tears easily along the perforations. After the sprocket-hole strips are removed and the paper is separated at the folds, you have separate sheets (usually lettersized). Fanfold paper works well for multi-page letters or term papers.

Some printers can accommodate paper of different widths. The paper width can be from 8 1/2 inches to 15 inches.

PAPER FEED

Many printers use friction to feed paper through. This method is the same as that used to feed paper through a typewriter. Other printers use two adjustable sprockets, called **tractors**, to pull paper with matching holes on the sides through. This is called **tractor feed**. To adjust for different paper widths, you simply change the distance between the tractors. Instead of adjustable tractors, some printers have only pins that align the paper. The pins and roller work together to move the paper through. These **pin-feed printers** usually cannot be adjusted much for different paper widths. Some printers are now available with both friction and tractor feed.

RIBBON

Most printers use ribbons packaged in a cartridge. The least messy ones can be changed without having to touch the ribbon. Some use regular typewriter ribbons. They are cheaper and may be easier to find. Consider the types of ribbons available for a printer before you make a decision to buy.

CONTROLS

The controls in printers vary. An **on-line** or **printer on-off switch** permits disconnecting the printer from the computer

while you change the paper, advancing the paper by hand, or performing other operations. A **form feed control** automatically advances the paper to the next sheet. A **form length control** lets you control the number of lines printed per sheet. A **self-test control** uses a test pattern to ensure that the printer is working properly.

Questions to Ask About Printers

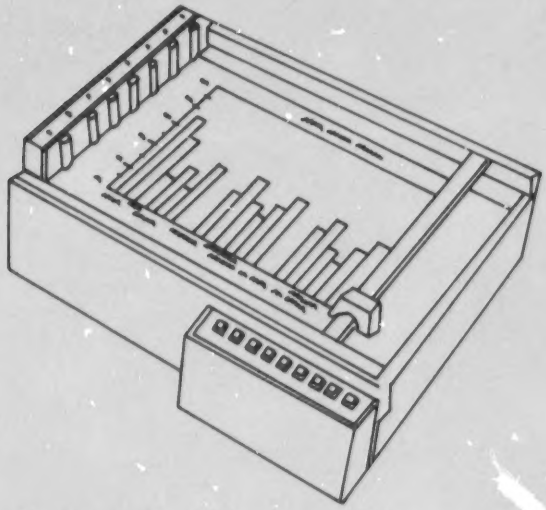
The following are factors you may wish to consider when purchasing a printer.

- Is the printer compatible with your computer?
- Is the printer compatible with your software?
- What quality of type does the printer produce?
- How is the type produced by the printer?
- What type styles are possible?
- Does the printer proportionally space characters?
- Does the type use true descenders for lower-case letters (g, j, p, q, and y)?
- Will the printer produce subscripts, superscripts, and special characters, if needed?
- What type graphics capability, if any, does the printer have?
- How many characters per second (CPS) will the printer print?
- Does the printer have a buffer? If so, what is its capacity? Can it be expanded? If not, can one be added?
- Does the printer have special features, such as bi-directional or smart printing, to increase its speed?
- What type(s) and width(s) of paper will the printer use?
- What type paper feed(s) does the printer have?
- How is the printer ribbon packaged?
- What controls does the printer have?
- How easy is it to change?
- How much does the printer cost?
- How much will paper and ribbon cost?
- How much noise does the printer make?
- How large and how heavy is the printer?
- Is service readily available for the printer?

Plotter

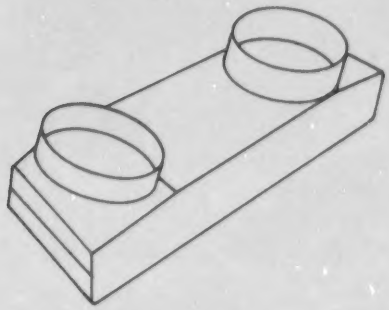
A **plotter** is a type of printer which produces charts and graphs from information provided by the computer. The illustrations may be in the form of graphs, bar codes, bar charts, pie charts, maps, drawings, and more. The plotted output may be in 2-4 colors. Three dimensional figures can be simulated by some plotters.

A plotter operates pen movements which are controlled by numerical data supplied by the computer. The results are easy-to-understand graphics. A plotter is ideal for business information such as financial trends, production data, and market forecasts. The illustration below shows a plotter.



Modem

A **modem** is needed to access a data base or communicate with a distant computer over the telephone lines. A modem converts the electrical impulses from the computer into tones which are transmitted over ordinary phone lines. Two types of modems are available—acoustic and direct connect. An **acoustic modem** or **coupler** allows you to plug the handset from a standard telephone into the modem after you have accessed a distant computer by dialing its telephone number. Occasionally the telephone handset hears or receives faulty tones, causing the acoustic modem to transmit errors. The illustration below shows an acoustic modem.



A **direct-connect modem** plugs into a standard wall socket or jack for modular telephone cords or into the headset of the telephone. A telephone may or may not be needed to dial the telephone number to connect with another computer, depending on the type modem selected. Phone extension cords as long as 25 feet can be used to provide flexibility in placing the computer.

Some modems will automatically dial or answer the telephone. **Automatic dial modems** will automatically "dial" a telephone number you type into the keyboard. **Automatic answer modems** will "answer" your telephone when it rings and send out a carrier tone. This **carrier tone** is the message to a distant modem that the computers can now "talk" to each other.

A modem may necessitate purchase of additional equipment. You may need an additional interface for connecting the modem to the computer. You may need a separate line cord to connect the modem. You may also need a software program called a **terminal emulator program** to interpret data base information for the computer. Finally, you may need a printer to make a permanent copy of data base material.

Questions to Ask About Modems

- Would an acoustic or a direct-connect modem work best for you?
- What length phone extension cord do you need?
- Will the modem, if direct-connect, automatically dial the telephone?
- Will the modem, if direct-connect, automatically answer the telephone?
- What additional equipment will you need in order to use the modem with your computer?
- How much does the modem cost?

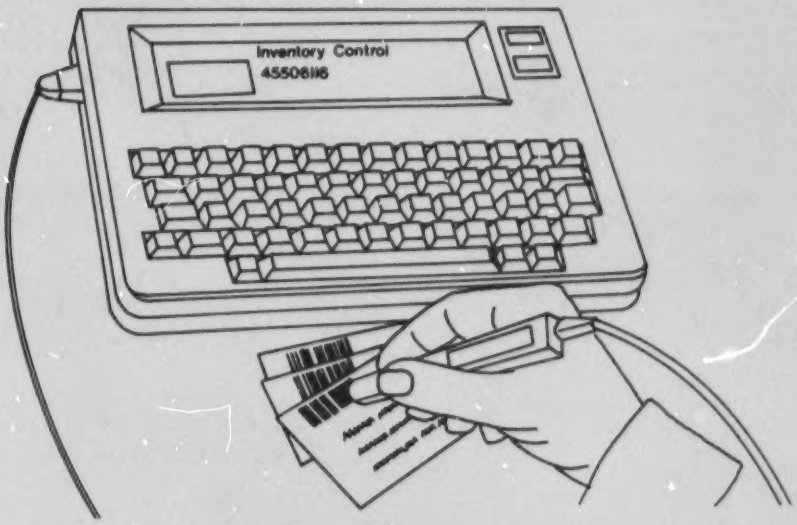
Card Reader

If you give a lot of true-false or multiple choice tests, you may be able to have students record their responses on cards with "bubbles" which can be filled in with #2 pencils. The computer can read the data using a device called a **card reader** or "mark sense" reader. Attendance, inventory, and scheduling also lend themselves to this kind of computer input. The bubbled-in cards can be fed into a card reader individually or stacked in a tray and automatically fed into the machine one at a time at very high speeds. The main disadvantage of bubbled-in cards is the limited kinds of responses for which they can be used.

Bar Code Wand

Most **bar code wands** look like a thick ballpoint pen with a light shining through the tip. It is used to read a series of lines called

a **bar code** which represent a number, title, or name of an item, or almost anything you want it to read. The code is read by passing the tip of the wand over the code. Bar codes are most commonly seen on grocery store items. In schools, bar codes could be used to identify textbooks or student identification numbers. A bar code wand is illustrated below.



Light Pen

A **light pen** is similar in appearence (but not in use) to a bar code wand. A light pen allows the user to identify the option or answer chosen by touching the approrpirate spot on the monitor screen. The computer "reads" the location of the light pen and responds accordingly.

The most common uses of light pens are to tell the computer which program option or test answer has been chosen. The computer responds by presenting the program option selected or indicating whether the student has selected the correct answer. Game playing is another common use of light pens. You can tell the computer where you want to make your next game move in Tic Tac Toe, checkers, or chess, for example, by placing the light pen on the correct square. Some programs allow a light pen to be used to draw sketches on the video-monitor for input into the computer's memory for printing by a computer.

Light pens are useful for educational programs that use a game format. They are also useful for younger children, the handicapped, or persons who are not skilled at typing.

A light pen is an inexpensive addition to a computer system. Most come with a few game programs that use the light pen for input. They also provide instructions for adding light pen input to other programs. The light pen is plugged into a port of interface card in the computer. A light pen may be included with the purchase of a more expensive video display monitor.

Paddles, Joysticks, and "Mice"

Paddles, joysticks, and "mice" are devices used to move a cursor quickly around the monitor screen. Each of these devices works in a different way.

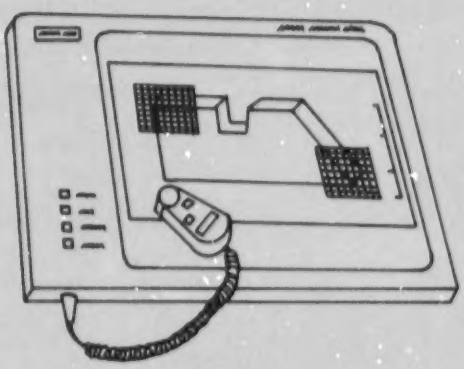
A **paddle** is a small hand-held device with a round knob about the size of a TV selector knob. A single paddle can cause a cursor to move either up and down or right and left on the screen, but not both. If two paddles are hooked up to the computer simultaneously you can also move the cursor somewhat diagonally by turning both knobs at once. Paddles were early game control devices.

A **joystick** is a more sophisticated device used to control what is happening on the monitor screen. It looks like a small box with a lever on top. The cursor on the monitor moves in whatever direction the lever on the joystick is tilted. The joystick allows the fast, 360-degree movements required in many computer games. Both joysticks and paddles have buttons that can send signals to the computer while the cursor is being positioned.

The **mouse** is the latest innovation for moving the cursor quickly around the screen. It consists of a small rectangular box with half a ball protruding from the bottom. It looks a little like a toy mouse on wheels. When placed on a desk top, the ball on the bottom allows the mouse to be pushed quickly and smoothly in any direction. As you roll it around, the cursor on the screen moves in the same direction as the mouse on the desk top. The versatile mouse can be used both to indicate responses (like a light pen) and to move the cursor (like paddles and joysticks). It can also be used to move designated words and numbers already on the screen to another location. "Mice" also have buttons for sending signals to the computer.

Graphics Tablet

A **graphics tablet** is a device which reads your drawn or traced designs into the computer. It can be used for a variety of purposes which require drawings or graphics. The drawing is usually done with a special pen or stylus. Special software may be necessary for its use. The illustration on the following page shows one example of a graphics tablet.

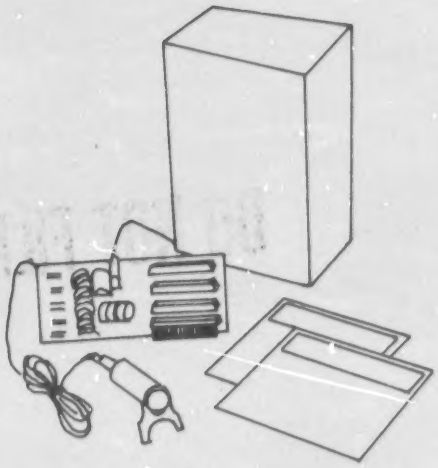


Speech Recognition Units and Speech Synthesizers

Some of the most interesting peripherals which can be added to small computers are devices to generate speech and to recognize or understand the spoken word. Such devices may be of interest in educational settings serving young children or handicapped students.

A **speech synthesizer** simulates the human voice. You have probably heard a speech synthesizer in a children's computer or possibly in a coin-operated beverage machine. A talking computer adds novelty to children's games and educational software. But more important, it can enable a blind person to use a computer by calling out the name of each key as it is pressed. In addition, students who cannot read can be given oral instructions rather than printed ones in computer-assisted instruction.

Speech recognition units have the ability to recognize different sound patterns. They allow the user to record spoken commands on a voice pattern disk. To do this the computer must be "trained" to recognize a particular person's voice and the commands to be used by that person. This is accomplished by typing in the words to be learned and then having the person speak each sound or word plainly when the computer prompts the person to do so. The computer will then execute the command whenever it is said aloud by that person. Although expensive, the speech recognition unit would allow a physically handicapped person who could not use a keyboard to use a computer. The illustration on the next page shows a voice recognition and speech sythesizer unit.



New computer peripherals are designed each year. Computer periodicals, computer store personnel, and computer user clubs can help you keep up with new and improved computer equipment.

Using Your Microcomputer

Chapter 7

You've taken the plunge and ordered microcomputer equipment for the home economics department. The delivery truck arrives and the boxes are brought to the department. Now what? It's time to put it all together, get acquainted, and learn how the parts of the system work together.

Putting It All Together

Before you can use your computer, you must find a place to put it. Then you must put it together and check it out.

CHOOSING A LOCATION

The use you plan to make of the microcomputer will influence your choice of a location. If you will have only one microcomputer which you plan to use primarily for demonstrations and for providing Computer Assisted Instruction (CAI) to small groups of students, you may choose a small, isolated area in the classroom. If several teachers will share one or more microcomputers, accessibility to all users will be an important consideration. If the microcomputer will be used for maintaining departmental records as well as for instruction, proximity to the department's office may influence its location.

Once you have chosen a general location for the computer system, note the following considerations for its placement:

- Install the system away from direct sunlight or sources of heat or cold. Avoid placing near a radiator, heating vent, or fireplace. Locate in a heated or airconditioned room or area.
- Avoid installing where moisture could get on or in the computer. An open window could expose the computer to rain or snow. The first computer use rule you should post is "POSITIVELY NO DRINKS."
- Connect the system and attached devices to separate grounded three-wire outlets. If you don't have such outlets, have a

licensed electrician install them (and grounding conductors, if necessary) where you will use the computer. Be sure each circuit is not one already used for power-draining appliances such as an iron or electric heater.

- Do not block air circulation around vent holes in the computer case.
- Avoid locating where excessive dust or dirt can get into the computer.
- Consider installing a room or furnace humidifier to reduce both airborne contaminants and static electricity if you live in a dry climate.
- Install an inexpensive voltage "spike protector" to prevent RAM losses.

ASSEMBLING THE PARTS

If the vender installs your system for you, you can skip this section. If not, read on. Some computer systems require more assembly than others. If you are uneasy about putting the computer together by yourself, ask a person who owns the same brand computer to help you. If you don't know someone yourself, see if a member of a local computer club might be willing to help.

Before you begin, clear a large table or desktop. Open the boxes and locate the owner's manual. Check the owner's manual to determine what tools are needed. (You probably won't need more than a medium screwdriver and a pair of pliers.)

Next, unpack the computer and its accessories. Check the packing list to be sure you have everything you're supposed to have. Examine the computer to be sure it arrived undamaged. Read the manufacturer's directions for assembling the computer and any additional equipment.

Now you are ready to put it all together. First, install all interface cards and their internal cables. Follow the manufacturer's directions for opening and closing the computer. Be sure to install the cards in their recommended slots. Cards designed for one brand and model computer may not work with another. If you have any doubts about whether a given card will fit your computer, consult your dealer. If the computer does not have a built-in monitor, connect either a videomonitor or a TV set with a RF modulator as a display device. Plug in the computer and display and see if they work. Next install any optional equipment such as a printer or modem. (*Always* turn the power off before attempting to connect optional equipment.) Connect their cables to the computer as directed. Be sure to follow the manufacturer's instructions. Test each peripheral before you install the next. When you have completed these steps, your computer system is ready to use.

Be sure to complete all warranty cards and mail them in. The warranty card registers your computer. The serial number(s) must usually be included on the card.

Getting Acquainted with the System's Components

With the system together, you are ready to get acquainted with each component: cassette recorder or disk drive, keyboard, and monitor. The first step in getting acquainted with your computer system is to READ THE MANUAL(S). The time you spend doing so will provide you with a basic understanding of your computer equipment and its operation. This will be both an asset and a time saver in the future. Once you have read the manual, turn the computer on and begin to familiarize yourself with its parts. The following descriptions of how computer components operate will provide general information, but your computer owner's manual must fill in the details.

CASSETTES AND RECORDER

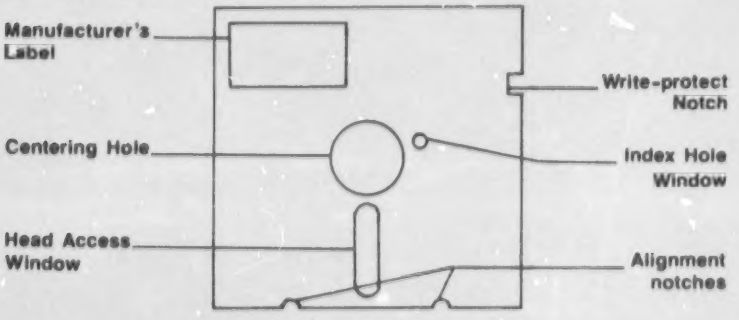
Choose high quality certified digital cassette tapes which have been individually tested and are certified not to lose bits of information. Cassettes used for audio applications may have small holes in the magnetic coating which could cause you to lose information from the tape.

You will have to experiment until you get the cassette recorder adjusted. Follow the computer manufacturer's instructions for adjusting the cassette recorder. Generally, you should begin with the volume control at midpoint, then attempt to **load** a program from a prerecorded tape into the computer. If the program does not load or an error message appears, you must reset the computer, adjust the volume, and try again. Once you find the correct volume, mark the exact setting on the recorder. This will save you time when you use the recorder with the computer again.

DISKS AND DISK DRIVE

The **floppy disk** used with most microcomputer disk drive systems is a 5.25 inch circular piece of plastic contained in a rectangular vinyl jacket. The vinyl jacket protects the disk and contains cleaning agents and lubricants to keep the disk clean and spinning freely. Touching the magnetic surface or placing a magnet near the disk will destroy recorded data.

Take a look at the illustration of a floppy disk below. Locate the parts identified in the illustration on an actual floppy disk. Hold the disk as illustrated with the manufacturer's label in the upper left-hand corner.



When the **write-protect notch** is open, as illustrated, information can be written on the disk or erased from it. When the notch is covered by one of the tabs that come with every blank disk, the disk is said to be **write-protected**. Any attempt to store information on the disk or to erase the information on the disk will result in an error message. Information already on the disk can still be read, however.

Tiny **alignment notches** are at the bottom of the disk cover. They are used to ensure that the disk is placed correctly inside the disk drive.

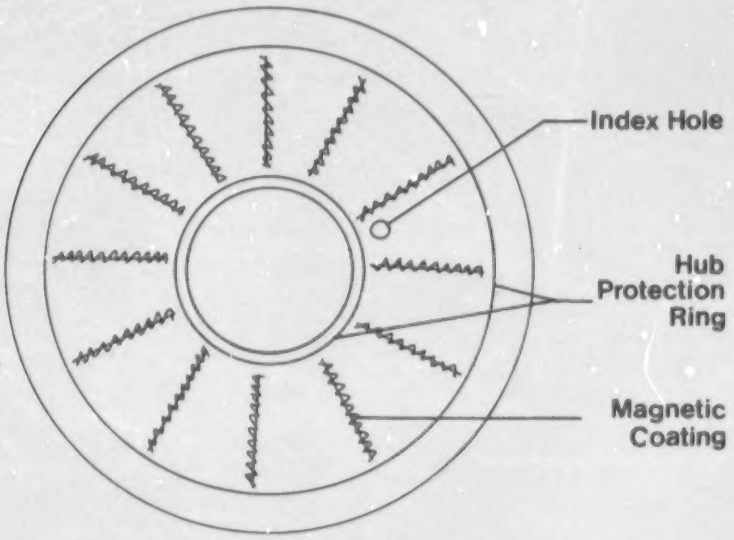
The **centering hole** is used to rotate the disk. The disk drive spindle fits tightly in the hole, allowing the disk to rotate.

The **index hole window** is a small round opening near the centering hole. It provides the disk drive access to the small index hole in the disk.

The **head access window** is the oblong slit in the disk cover. It allows the head of the disk drive to read and write on the magnetic surface of the disk.

The amount of data which can be stored on a disk can vary greatly from one disk drive and one disk operating system to another. A **single density disk** drive stores only about half as much information as a **double density disk** drive. A **double-sided disk** can store information on both sides of the disk.

The disk itself is round. As shown in the illustration below, it has a protective ring called a **hub-protection ring** around the center hole and around the outside edge. It has a single **index hole** near the center hole. Inside the disk drive when a beam of light shines through the index hole the computer "knows" that the disk has completed one revolution. A one-inch ring around the disk's surface has a magnetic coating that is used to store data.



The disk you use may be either a startup (auto-booting) disk or a non-startup disk. A **startup disk** contains both information to get your computer started (an **operating system**) and one or more application programs. When you use a startup disk you do not need a separate disk to get your computer started. Most commercial applications programs are on startup disks. Generally, you start such a program by placing the disk in the disk drive and turning on the power or resetting the computer.

The blank disks you use for storing the programs you create are usually **non-startup disks**. These disks contain no operating system. To use programs on non-startup disks, you must first load into the computer's memory the operating system for which the program was written from one disk. Then you load the application program itself from the non-startup disk.

To insert a disk into the disk drive, first make sure that the **in-use light** on the front of the disk drive is *off.* (Remember removing a disk while the light is on may damage the disk or destroy some of the information on it). Next, open the small door on the front of the disk drive. If a disk is already in the slot, remove it and put it away. Grasp the disk you want to use by the manufacturer's label and remove it from its envelope. Gently push the disk into the disk drive slot, alignment notches first, label up. Do not bend or force the disk. If you cannot insert the disk easily, remove it carefully and try again.

To remove a disk from the disk drive, first make sure the in-use light is off. (Remember never to remove a disk when the in-use light is on!) Open the small door on the front of the disk drive. Carefully pull the disk from the slot and return it to its envelope. *Always remove any disks from the disk drives before turning off the computer.*

Booting. Computer systems vary regarding whether to insert the disk into the primary disk drive before or after turning the power on when you are starting up (**booting**) the system. Some manufacturers say insert the startup disk in the drive before turning the computer on. Others say do so after the power is on. Check your owner's manual to see which way is recommended for your system.

As the information from the disk loads into the computer's memory you will hear whirring and clicking noises. The in-use light on the disk drive will light up. When the information on the disk has been loaded into the computer's memory, the light will go off and the monitor screen will show a startup message to let you know it is ready for use.

To restart the system with the power on, insert a user's disk in the primary disk drive and close the drive door. Follow the manufacturer's directions for restarting the system. Again, the disk drive's in-use light will come on and the drive will make whirring and clicking sounds while the disk is read. The disk's

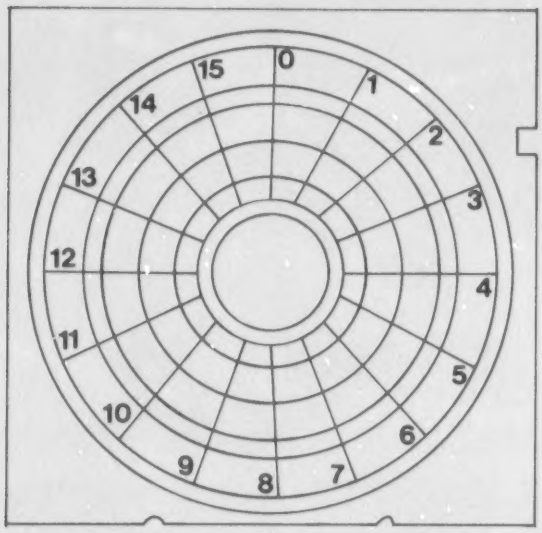
opening message will appear on the display screen when loading is complete. It is better to follow the manufacturer's recommended procedure for restarting the system with the power on than to restart by turning the power off, then on again.

The disk drive is controlled by **disk operating system** software. These programs are loaded into the computer's main memory from an operating system disk. These programs are used to move information and to make it easy to use the disk drive.

The operating system disk usually includes programs for initializing or formatting a disk, for loading information from a disk, for saving information on a disk, for copying a program or a whole disk, for determining what is on a disk, and for transferring information to other devices. It also displays error messages on the display screen when something goes wrong. Check your owner's manual for a list of the error messages generated by your disk operating system and the meanings of these messages.

Initializing. Blank disks have nothing recorded on them. They are blank, just like a blank cassette tape. Before you can record information on the disk you must prepare it using a process called **initializing** or **formatting**. This is done using an operating system program which writes concentric circles of zeros (called **tracks**) on the disks. These circles, like the grooves in a record, tell the disk drive where to write information. The disk drive divides each track into several pieces, usually 10 to 16, called **sectors**. Different disk operating systems use different numbers of sectors per track. They also read and write on the disk in different ways. Therefore, a disk formatted for one disk operating system may not work with another. Follow the instructions in your disk operating system manual for initializing disks.

You can visualize a formatted disk something like this:



16-Sector Disk

When you tell the computer to save information on a disk, the disk operating system program divides the information into sector-size pieces for efficient transfer and storage. The stored information is called a **file**.

Creating Files. Some sectors on the disk are reserved for a table of contents. These sectors contain the name of the disk and the names and locations of all files stored on it. The table of contents may be called a **catalog**, a **menu**, a **library**, or a **directory**. To see what is on a disk, type the appropriate command for your computer and press the return or enter key. After a second or two, the directory should appear on the screen.

Now you are ready to run the program of your choice. Install the disk and give the command appropriate for your computer. Some programs require you to type in the exact name of the program as it appears on the directory and press the return or enter key. In a few seconds your computer will locate, load, and start the program. Other programs only require loading the disk. When the program asks (**prompts**) you for information, type in the answers on the keyboard.

The program may provide periodic opportunities for you to return to the main menu or to quit, and even tell you how to do so. If not, or if you want to stop at another point, you can return to the beginning of the disk by resetting the computer as directed by the manufacturer. If the reset procedures do not work, simply turn off the power. However, you should rarely need to do this.

When you create or type in a new program or file, it is stored in the computer's temporary memory. If you want to save it for later use, you must store it permanently by transferring the program to a blank space on a disk. Check your user's manual for procedures for **saving a disk**.

Copying a Disk or File. You will also need to learn how to copy a disk. This will enable you to copy a friend's program or to make a backup of a program or data. Making a **backup** means saving your work on two disks instead of one to prevent loss of the information if one copy is damaged.

To copy one disk onto another, you will need a disk with the write-protect notch uncovered. (Remember, covering this notch prevents accidentally writing over information on the disk). You cannot copy information onto a disk which has no write-protect notch, or onto one that has the notch covered. These disks are **write-protected**. If you want to avoid accidentally writing information over what is stored on a disk, you can write-protect the disk yourself by simply sticking one of the small tape tabs supplied with your blank disks over the write-protect notch. With the notch covered, the computer cannot write any information onto the disk or change the information which is already there.

Most commercial software is **copyrighted**. Copyright law allows the purchaser of software to make one backup copy for archival purposes. However, this is not always possible because most commercial software is also **copy protected**. This means that the software is designed so that it is difficult to copy it, or so that it won't work if you do. It is illegal to make a copy of copy protected or copyrighted software (except as specified by law), but other software is in the public domain (not copyrighted or copy protected) and may be copied by anyone.

KEYBOARD

Most microcomputers used in schools have a keyboard similar to an ordinary typewriter. Three types of keys are usually provided:

- Printing (visible) characters
  - letters (capitals and maybe lower-case letters)
  - numerals (0-9)
  - special characters (punctuation and symbols)
- Control characters
  - Some control characters use single keystrokes. These usually include the cursor movement keys: return, tab, and four arrow keys. Another control key is the escape or break key.
  - Some control characters are formed by pressing the **control** key in combination with a printing character key (usually a letter key). Study the owner's manual to learn about these control characters.
- Special function keys
  - These keys cause the computer to do special things like reset or restart, escape or break, or perform a self-test.
  - Their locations vary from one computer to another. Study the owner's manual to learn about the special function keys on your computer.

In general, the printing characters are for typing information and the control characters are for commanding the system to do something. Special function keys tell the computer to do something special.

Avoid making keyboard substitutions for letters, numbers, and symbols unless directed to do so. Especially, be sure to avoid using the following letters for number substitutions: a lower-case "L" for the number "1" (one) and the upper-case letter "O" for the number "0" (zero). Computer manuals often put a slash through zeros to remind you of the difference. Also you cannot interchange single (') and double (") quotation marks.

All microcomputers provide upper-case letters. Most also provide lower-case letters. If both types of letters are available, you *must* use either the shift key or the **caps lock key** to get capital letters. The caps lock key locks the keyboard so you can enter the alphabet keys in upper-case only, or unlocks it so you can enter both upper- and lower-case letters. Some application programs recognize only capital letters.

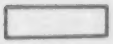
Some computers have a **repeat key** which allows you to repeat a character without striking the character key over and over. Others allow you to simply hold down the character key to repeat.

The **space bar** functions the same as on a typewriter. However, because computers are not as good at interpreting what you type as people are, it is important to always press the space bar to space between letters or words. Sometimes the computer cannot interpret your commands correctly if necessary spaces are not included. In addition, you must use the space bar, not the right-arrow key, to add a space character.

Like most typewriters, computer keyboards provide two **shift keys**, one on the right and one on the left. The shift keys allow you to type the upper character printed over some of the keys on the keyboard. If your computer generates both upper- and lower-case letters, it also allows you to type capital letters.

The **return** or **enter key** serves two purposes on the computer. It functions like the carriage return on a typewriter by indicating the end of a line and causing the cursor to move to the beginning of the next line. In addition, it indicates the end of a command when you are giving commands to the computer or the end of a program line when you are writing a program. In this role, it is a means of passing control from you to the computer.

The **cursor** shows you where what you type will appear on the display screen. It also indicates that the computer has finished a task, is returning control of the computer to you, and is waiting for your next message. The word *cursor* is Latin for "runner." The position of the cursor is controlled by the space bar, the return key, the tab key, and the four arrow keys.

Key		Moves the Cursor
	Space Bar	One space to the right.
	Return Key	To the beginning of the next line.
	Tab Key	To the next tab setting. Tabs are usually preset to multiples of eight character positions. Some programs let you set your own tabs. Some computers use the right-arrow key as a tab key.
	Left-arrow Key	One position to the left. Can be used to remove information.
	Right-arrow Key	To the right. Some systems use this key to move the cursor one space, others one tab, to the right. Some programs let you use this key to copy text that is already on the screen.

	Key	Moves the Cursor
	Down-arrow Key	Down one line, without erasing what you typed
	Up-arrow Key	Up one line, without erasing what you typed.

The **escape** or **break key** is an important control key. It is used to terminate execution and return control of the computer to the user.

The **reset key** is used to perform special functions. These functions might include restarting the system when the power is on, stopping a program (some programs ignore this command), or starting the computer's built-in self-test.

DISPLAY SCREEN

The **display screen** lets you view what you are typing. If you notice errors on the display screen, you can move back to that point and correct the error instead of retyping everything. As you type information into the computer, the information soon exceeds what you can see on the screen at once. The display screen displays only a windowfull of information, much like a "broomstick" movie. Some of the information you have typed disappears from view as you type in additional information. This is called **scrolling**. Some programs even allow you to split the display screen into two or more windows (or **viewports**) to view several different places on the scroll at once.

As you use a commercial software program, program information and graphics will appear on the display screen. Questions or prompts requiring your response will also appear as will the answers you type in.

Error messages from the disk operating system software, the language interpreter, or even the application program may also appear on the display screen. Common error messages include the following:

Error Message	Meaning
File Not Found	The file name may have been misspelled or else the file is not on the disk. Check the disk's table of contents.
I/O Error	There may be a poor connection between the computer and the disk drive or printer, or the disk may not be properly aligned in the disk drive slot, or the drive door may not be closed.
Syntax Error	The computer does not understand your input. The most common cause is a typing or spelling error.

Error Message	Meaning
Type Mismatch	You did not use the appropriate commands or language for the file. Check the manufacturer's instructions.

Check your owner's manual for a list of the error messages which can be generated by your computer's language interpreter and disk operating system. Also check instructions to application software for error messages which may be generated by application programs.

Learning How the System Works Together

Now that you are acquainted with the parts of the system, let's take a brief look at how the components work together. When you turn on the computer you only have access to the software stored in the computer's permanent memory (Read Only Memory or ROM). This includes a monitor program and a language translator (usually BASIC). The **language translator** converts the words and abbreviations you type at the keyboard into machine language instructions for the processor. The **monitor program** starts up the system when you turn it on and provides single instructions to the computer.

The monitor program tells the computer to look for a disk in the primary disk drive and to load the disk operating system program into the computer's main memory (RAM) if it finds one. You now have access to the disk operating system. You can command the computer to load and run (use) selected programs. Remember that if the application program is on a startup disk you will not need a separate disk operating system disk. If you want to type in a program of your own, you will begin with the disk operating system disk. If you are using a cassette recorder instead of a disk drive, the monitor program can load, save, and run the cassette programs, but that is all.

When you are finished using the computer, you can save information you want to keep as a file on a disk. You can also instruct a printer to print the information.

Beyond the Basics

Chapter 8

You have selected a computer system, put it together, and learned to run it. You're well on the way to becoming an effective computer user. Where do you go from here?

If using application programs has made you wish you could make a few changes or if you'd like to develop a few programs of your own, you are ready to learn some programming skills. To put it simply, programming is writing step-by-step instructions to tell the computer what to do. But, where can you learn programming? There are several sources of instruction. Let's explore a few.

Sources of Instruction

One way to get your feet wet is to take a short course at your local computer store. Some stores offer instruction free to educators or with the purchase of computer equipment; others charge a fee. Find out which course(s) would meet your needs. Find out who teaches each course you are considering and what the person's qualifications are. Talk to individuals who have taken the course. Find out what the course covered and whether students were satisfied.

Your local community or junior college, college or university may offer computer programming courses. These courses are usually more in-depth courses than the short courses offered at computer stores. Find out what programming language is taught. Be sure it is one you want to learn. Find out whether the focus of the course is appropriate for you. Talk to the instructor and past students about the course.

Computer clubs and user groups may provide some programming instruction or help you locate someone who would be willing to help you learn. These groups often share programs

developed by members and help one another solve problems related to computers and programming.

Numerous self-instruction books and software programs are available to help you learn to program in a variety of languages. Your computer dealer can help you locate one to suit your needs.

Programming Languages

Before you invest many hours of your valuable time learning a programming language, become familiar with the languages available and their purposes. Then choose the one that best meets your needs.

Computer languages can be loosely divided into two groups: **high-level languages** and **low-level languages**. High-level languages, such as BASIC, PILOT, Pascal, Logo, FORTRAN, and COBOL, use commands and concepts similar to English. They do not require an intimate knowledge of the computer. At the other end of the spectrum are the low-level languages: assembly language and machine language. These take longer to learn, but provide more control over the computer. Learning any computer language well enough to write useful programs will take many hours of training and practice.

Programming languages are made up of words and abbreviations designed as intermediate steps between the language you speak, English, and the language the computer speaks, machine language. English is too complicated for a computer to understand.

HIGH-LEVEL LANGUAGES

BASIC (Beginner's All-Purpose Symbolic Instructional Code) is the most widely used language in elementary and secondary schools. It is the language that is available for every microcomputer. BASIC is a general-purpose language with which many programs have been written. Although there are various versions or "dialects" of BASIC all are fairly easy to learn and use. Because it is a **conversational** or **interactive language** (in other words, it pauses for user responses to questions), BASIC is well-suited for educational applications. You will probably want to learn enough BASIC to be able to read and write simple programs. To do this, you will need to learn the basic commands and statements. You can learn enough commands to write simple programs in just a few hours.

PILOT is a computer language designed for teachers. A teacher can use it to create computer assisted instruction (CAI) on almost any subject. It is especially tailored for such instructional tasks as drills, tests, and dialogues. The instruction can include color graphics, sound effects, lesson text, and answer checking. Since the lessons are saved on a disk, a teacher can create a versatile lesson library, allowing students to learn at their own pace. Like BASIC, PILOT is a conversational language. PILOT is also a language that's easy to learn and easy to use. In fact, the original version uses only the following eight commands:

- T *Type* something on the screen.
- A *Accept* information or answer.
- M *Match* the answer to the answer that was expected.
- J *Jump* to a different place in the program. This command is controlled by inserting an asterisk (*) and a label in front of the statement line where the program is next to operate.
- U *Use* a subroutine or short segment of the program that will complete a limited task. Then when it encounters an E, it will return to the line that followed the U.
- E *End* the program or subroutine.
- R *Remark* allows you to enter comments that will not be shown on the screen as part of the program, but that will remind you of your intentions in creating the program.
- C *Compute* or count as directed.

Each version of PILOT is different and each has become increasingly complex.

Pascal is a "structured" programming language. This means that every Pascal program follows a basic outline or structure. Smaller subprograms which are part of the program also follow the same basic structure. Pascal was designed to teach computer programming as a clear, systematic approach to problem-solving. Pascal statements are put together much like statements in ordinary language. Pascal programs are a good mental exercise; they help you think clearly about the method for solving a problem. Perhaps that is why Pascal was selected by the College Board as the language to be used in the computer science advanced placement exam beginning in 1984.

Logo is a fairly new language that is so simple a child can use it (although it's suitable for adults as well). Following Piagetian developmental theory, it introduces programming in an intuitive way. It incorporates **Turtle Graphics**, a feature which makes it possible for the user to create geometric designs by moving the cursor—or turtle—in any direction on the screen by using simple commands such as Forward 100 or Right 90. **Bugs** (program activities that don't work right) are treated as normal occurrences in any learning process, instead of being treated as wrong answers. Logo is designed to convey programming concepts in a natural problem-solving manner.

Two other computer languages you will encounter are FORTRAN and COBOL. **FORTRAN** (FORmula TRANslator) is one of the oldest and widely used computer languages. It was developed for solving problems in mathematics, engineering, and science. Today, it is also used in business and education. **COBOL** stands for COmmon Business-Oriented Language. This language was designed expressly for business and commercial applications. Neither of these languages is likely to be one the average teacher will want to learn.

LOW-LEVEL LANGUAGES

The central processing unit, the "brain" of the computer, recognizes only coded numbers called **machine language**. Machine language, which consists only of 1's and 0's is too hard for most people to understand.

To bridge the gap between programming languages and machine language, the computer uses **language translators**. There are three kinds of programming language translators:

- An **interpreter** translates into machine code statement by statement (like a translator at the United Nations) or keeps a copy of the original program language and translates it each time the program is run.
- A **compiler** translates an entire program into machine code at once (like a book translator).
- An **assembler** translates the program instructions one for one into machine code.

Graphics

Graphics add appeal to educational software just as they do to games. Graphics make it possible to create bar graphs, line graphs, scatter diagrams, or pie charts. Still or animated high resolution color graphics can also be created.

Described simply, **computer graphics** are a planned method of turning on and off lights on the screen. The most common method of producing computer graphics is via the keyboard. Unfortunately, it is fairly difficult to write graphics programs in BASIC. Furthermore, most of the fast, exciting graphics displays you have seen are impossible to do in BASIC and were probably done in machine code (assembly language). Graphics can also be created using a **graphics tablet** which allows you to draw or trace designs with your finger or a magnetic pen or stylus. The pictures or graphs are easily stored in the computer's memory. Programs are also available for producing graphics inexpensively.

The quality of graphics which can be produced is affected by the resolution of the computer's graphic display and by the number of colors available. **Resolution** refers to the number of individually accessible points on the display screen. Resolution is usually expressed as the number of horizontal display points by the number of vertical display points. For example, 280 X 192 is a resolution of 53,760 points. The number of colors offered varies from one to 16 colors.

Program Design

A computer can't do anything unless it is told what to do and how to do it. The list of instructions that tell a computer what to do is called a **program**. Once you have become a proficient user of application software, you may want to design some educational programs (**courseware**) of your own. You can accomplish this either by using authoring software or by using a programming language. **Authoring software** enables teachers to put their own educational materials into an existing framework without having to learn a programming language. Either way, the steps in developing a quality software program are similar.

1. *Define your need for software.* The first step in developing educational software is to identify the content area, topic, and learning module for which you need software. At this point you should also identify the type of students (by grade level, ability level, and learning style) who will use the program.

2. *Write instructional objectives.* Carefully choose the instructional objectives for the program. Clearly state each objective in behavioral terms. This will help you to specify the content of the program. It will also aid you in determining what prerequisite skills, vocabulary, and concepts are necessary for the student to successfully use the program.

3. *Plan the instructional design.* Decide which overall instructional design is most suitable for the objectives–drill and practice, tutorial, simulation, or problem-solving. Decide what you want the program to do. Write a detailed description of what will be included (menus, operating procedures, error messages, storage requirements, and general theory of operation).

4. *Develop instructional content.* Outline the content in the order in which it will be presented. This will help you maintain consistency between the content and the program objectives. Write out the lesson in narrative form as you might a detailed lesson plan. Indicate how you will determine whether the student has learned the skills or concepts presented. Try out each problem or exercise on paper and note the correct responses. Decide how incorrect responses will be handled.

5. *Design student evaluation.* Decide how you will test the student's achievement of program objectives. Also decide what records the program should maintain of the student's performance. These records can help you evaluate both the student's performance and the program itself.

6. *Draw a diagram or flow chart.* A **flow chart** is a graphic description of the steps in the program. It will provide you an overview of the total program. It helps you check the logic of the steps in the program. The typical flow chart uses about a dozen symbols to represent the steps in the program.

7. *Plan screen displays.* Write, type, or draw the screen display for the program frame by frame on sheets of paper or index cards. Examine the lesson plan and flow chart and decide what the user should see on each frame of the program. Each frame should be numbered in logical order and should indicate what frame to go to if a frame is correct, incorrect, or inappropriate. See the "Guidelines for Planning Screen Displays" on the following page.

Guidelines for Planning Screen Displays[1]

- *Design screen displays so they are easy to understand.* For ease of reading, six lines of text, double spaced, serves the needs of most students. Break lines between phrases and avoid a crowded display. For young learners you might wish to use enlarged or colored text, if you have a computer that has this feature. Screen displays printed in capital letters are not as easy to read as "conventional" print with capitals and lower-case letters. A neutral color for the screen is also easier on the eyes than the typical blue screen.
- *Important information, new vocabulary, key words, and instructions can be highlighted by using inverse print or color.* Use flashing words, letters, or phrases judiciously as they can be more distracting than attention getting.
- *Make sure you follow the established rules for punctuation, grammar, usage, and capitalization.* Avoid spelling errors.
- *Have the learner respond frequently.* Plan your program so that the user readily understands how to respond. For example, if you have a clock set at six-fifteen and the user must respond to "what time is it?", indicate clearly how to respond; i.e., ____ hrs. and ____ mins.; or ____ mins. after ____. If the user does not understand how to input his/her response it will cause unnecessary frustration.
- *Include frames that positively reinforce correct responses.* Reinforcement should be variable and random, making use of behavior management principles. Do not make frames that follow incorrect responses punishing, nor exciting enough to encourage making errors.
- *Use branching to meet the individual needs of the learners.* Branching reduces frustration for learners having problems as well as for pupils who have learned the material.
- *Graphics, sound, and color should be an integral part of the program.* Use them to convey information, draw attention to important facts, or reinforce learning. Effective graphics are not simply an added attraction. Use sound judiciously. Too much can be wearing on the nerves. Do not use sound to indicate mistakes because it announces the student's errors to those around him/her.

[1]Marion Lorenz and Allan Moore. "Writing Instructional Software," *Micro*, September 1983, pp. 44-49.

8. *Code the program.* Translate your written instructions into the programming language that you are using. This results in a set of BASIC or other language statements representing the program. If you are using authoring software, you will skip this step.

9. *Edit the program.* Go over each line of the program carefully. Check for spelling, content, grammar, syntax, and punctuation errors. Evaluate each frame in terms of readability and overall appearance. Double check the "flow" of the program using the flow chart and the frame sheets or cards. Make sure every frame leads to another appropriate frame until the end of the program is reached.

10. *Type the program.* Type the program into the computer. Be sure to clear the computer's memory of other programs or information before you begin. Remember, if you have not pressed enter or return, you can correct a line by pressing the left-arrow key.

11. *Debug the program.* Getting rid of the "bugs" or program errors is an important part of program development. It requires proofreading and preliminary testing. First, print out the program and check for typing, spelling, punctuation, and grammatical errors. Next, run the program several times. Be sure it works from beginning to end regardless of what branches are taken or what is typed in by the learner.

12. *Test the program.* After obvious errors have been corrected through debugging, the program should be tested using a representative sample of learners. In doing so, observe the learners as they use the program. Ask the students to evaluate the program. Check the records maintained by the computer of the learners' responses.

13. *Revise the program.* Rewrite necessary portions of the instructional sequences or incorporate needed new material into the program. Be sure to repeat the validation process after you complete the rewrite. Continue the process until you are satisfied with the program. At this point, you may also wish to rewrite the program to streamline it or speed its operation. Or you may want to add internal instructions.

14. *Write documentation.* The final step in developing a program is writing the **documentation** or user's guide. Documentation tells how the program is supposed to work. The guide should include the following:

- A description of the program.
- A description of the intended learners.
- A list of prerequisite skills required for using the program.
- A list of the instructional objectives on which the program was based.
- A list of any specialized vocabulary words included in the program.

- Procedures for running the program.
- Information and materials to enhance the program's educational value.
- Information on evaluating the learner's achievement of the program's objectives.

Field test the user's guide with teachers and students who might use it. Then rewrite it, if needed. As part of the final documentation of the program, update the design specifications and flow chart to reflect changes incorporated in the final program. And finally, print out a listing of the final program.

Care and Repair of Your Computer System

Chapter 9

Like any other equipment, a computer system requires care and occasional repair. Appropriate routine care will help you avoid many costly repairs.

Care

A few special supplies are needed to keep a computer in good order. A schedule for cleaning will help to ensure that your system works properly and requires minimal repairs.

CLEANING PRODUCTS

Many cleaning products are available for computers and electronic equipment. Screen-cleaning solutions, pressurized clean-air canisters, and lint-free cloths are important aids for computer care. A disk drive cleaning kit, preferably one that contains a special disk and solutions, lets you clean drive heads by simply inserting and activating the drive for about 30 seconds. Check your owner's manual or ask your dealer to learn which one is recommended by the manufacturer so you do not void the warranty.

WEEKLY CLEANING

Weekly cleaning of your computer system and the surrounding area will help keep problems to a minimum. Inspect all air vents and intakes. Give special attention to filters and fan housings where screens or filters may block the air flow. Replace or clean filters and screens in accordance with the manufacturer's recommendations. Check the cables to printers, terminals, disk drives, and modems to be sure none are loose. A loose connector is a common cause of system failures and communication problems. Connectors can work loose simply from normal operating vibrations of fans, disk drives, and printers.

MONTHLY CLEANING

Monthly, take time to inspect the inside of your computer if doing so will not void your computer's warranty or your service contract. Be sure the power is off and the power cord is disconnected before opening the cover. Remove the cover and check for accumulations of dirt and dust. Carefully remove the dirt and dust, especially around boards and connectors, using tweezers and a canister of air. If you use a cassette recorder, clean its recording head. Check the manufacturer's instructions or ask your dealer.

If the disk drives can be opened, check inside for wear and buildup. Check the rails on which the heads ride for wear and for dust and dirt. Check for "burn marks" and abrasions on the magnetic heads. Check for excessive deposits of oxide worn from disks. Such deposits could indicate problems with either the heads or the disks. Clean the disk drive heads using the procedures recommended by the manufacturer. Manufacturers usually recommend a head cleaning kit. Regular cleaning with this kit will help prevent costly disk drive repair later. You simply insert the head-cleaning disk into your disk drive, turn the drive on, and let the head clean itself. The kits should not be used too frequently, though, because the cleaner that removes oxide buildup can also scratch the read/write head.

Check the mechanical components of your printer for evidence of wear. Look for worn spots on moving surfaces, especially on the rails and bearing surfaces of the print head and print hammer. Clean any accumulated paper chips and fibers from inside the printer.

OCCASIONAL OVERHAUL

Once or twice a year, your computer system should be stripped, cleaned, and reassembled. You may prefer to pay a technician to do this for you. Circuit boards should be removed and the edge connectors and sockets cleaned. The seating of all integrated circuits should be cleaned. The seating of all cables should be checked. Key tops should be removed from the keyboard and accumulated dirt cleaned out. If any mechanical parts should be lubricated, this should be done as directed by the manufacturer's service manual.

CARING FOR CASSETTE TAPES

Store cassette tapes in their plastic boxes in a clean area. Keep the tapes away from electric or magnetic fields. Do not expose them near motors, magnetic tools, static electricity, excessive heat, etc. Remember not to lay them on top of your cassette recorder (it contains a motor).

CARING FOR DISKS

With reasonable care, a disk will give you an average life of about 150 hours. That is a long life when you consider the few seconds the disk is actually used for loading or storing infor-

mation. The following pointers will help you ensure a long life for your disks:

- Write on the label before attaching it to the disk. If you must write on a label already attached to a disk, use a felt-tip pen (never a pencil or ball-point pen) and write lightly. Also, avoid using an eraser on the label as the abrasive eraser dust can damage the disk.
- Hold the disk by its jacket. Never let anything touch the brown or gray surface of the disk itself.
- Do not place disks on dirty, dusty, or greasy surfaces.
- Do not expose the disks to moisture, extreme temperatures, or sunlight.
- Do not bend or attach paper clips to disks.
- Keep disks away from magnets or electrical devices like telephones, television sets, and motors. You may, however, place the disk temporarily on the computer or disk drive.
- Insert the disk into the drive gently and close the door. Do not force the drive door to close.
- Remove disks from the drive if you will not be using them for a long time, even if you leave the computer on.
- Remove disks from the disk drive before turning off the system. Failure to do so could destroy the contents of the disk on some systems.
- Store disks upright in their protective envelopes.

Disks won't last forever, even with the best care. A disk must be discarded when you develop problems writing information onto the disk or in reading information from it. You will also have to discard a disk if it consistently gives you "track errors" when you are formatting it.

Trouble Shooting

Your system is on the blink? There's a lot you can do to locate and possibly solve the problem before you call the repairperson. The following are some typical problems you may encounter and the checks you can make to pinpoint the problem:

Problem	Things to Check
No power	Check power cord connections from computer to wall outlet. Check for switch or breaker in off position. Check for blown fuse.
No cursor on display screen	Be sure the video display is turned on. Adjust the brightness and contrast controls. Be sure the video display is plugged into outlet. Be sure it is correctly connected to the computer. Turn the computer off, wait a few seconds, then turn it back on. Turn off the computer, disconnect

Problem	Things to Check
	everything except the monitor, and start the system's self-tests, if available.
System or boot errors when starting up the system	Try booting the system with several other disks to see if the problem is in the software. Try the diskettes in another computer to see if the problem is in the hardware.
Numerous errors during data processing	Be sure computer is not near heat source. Be sure air intakes, vents, fan inlets, and other openings are not blocked. Spread components out instead of stacking them. Install cooling fan if needed. Try the diskette in another computer to see if the problem is the diskette.
Whirring in wrong disk drive when you start up the system	Be sure you have booted the primary drive.
Disk drive in-use light stays on; drive makes even whirring sound	Be sure disk drive door is closed. Check to see that disk is centered in the drive. Try resetting the computer. Be sure the disk is formatted for this drive system and is not blank. Try another disk.
Disk drive makes rattling sound	Remove disk from drive; replace it making sure it is properly aligned. Be sure disk was placed in drive properly, label up, alignment notches first. Determine whether disk may be blank or formatted for another operating system or language.
Disk drive makes weak whirring sounds	Check all cables for tightness. Be sure disk controller card is in correct slot. Remove and reinstall the disk controller card.
Disk drive makes sounds, then stops; nothing on display screen	Be sure video display is plugged in. Be sure video display is turned on. Check connections between video display and computer. Check brightness and contrast controls on video display.

Problem	Things to Check
Cannot load program from cassette recorder	Check volume control settings. Check cable connections and condition. Be sure cassette tape is rewound and on the correct side. Be sure the recorder is not a high fidelity recorder which will not work well for loading programs into a computer.
Modem doesn't work	Be sure communication card is correctly installed. Consult with electronics or computer dealer.
Power surges cause data file to be lost	Find out if heavy electrical machinery is in operation in the area. Try to determine if a nearby home appliance or office machine might have a defective switch. Have appliance or equipment repaired. Install a line filter.
Static electricity	Place computer in an area without carpet. Install a humidifier. Purchase an anti-static floor mat.

Repair

When you determine that your system has a problem you cannot correct, take time to answer these questions before you contact a repairperson:

- Are you sure the problem is not in the software?
- Can you isolate the problem to a single component of the system?
- Is the problem constant or random?
- Does the problem occur only when the equipment heats up or cools down?
- Does the problem occur only during a certain function or operation?
- Have you written down a complete and accurate description of the problem and its symptoms?

Some computer repairs can be made locally. Other times the equipment must be returned to the manufacturer for repair. Obtaining service for a computer system may be a problem if you do not live in a major metropolitan area. Check with other computer users to find out which local service center is best if you have a choice. Seek out authorized repair centers or authorized third-party service first. Get to know the people at your local computer dealership.

When you take your computer equipment in for repairs, get time and cost estimates. Find out if the shop will lend you a computer until yours is repaired. Ask the service center to call you if the repairs exceed a certain amount.

When you get the repaired system, ask the service center to list in detail what was done. If the equipment was repaired locally, ask to test it before you leave. Be sure to get a warranty on any replacements such as a board or a disk drive.

Service Contracts

Before your computer system needs repairs, you may want to investigate service contracts that cover parts and labor. Check with your school purchasing office to determine school policy regarding service contracts. Service contracts cost about 12 percent of the cost of the equipment per year. Most systems can probably expect no more than one or two equipment failures a year.

Part III
Software–
Selecting, Using, and Storing

Computer Assisted Instruction

Chapter 10

Computer assisted instruction (CAI) is the use of microcomputers for educational purposes. CAI occurs when a student sits down at a microcomputer terminal and proceeds to interact with the computer according to instructions given by a teacher. Many such interactions are directed by educational software chosen by the teacher to fulfill specific course objectives. CAI also occurs when a teacher or other professional uses the microcomputer for evaluation or for diagnosis of special needs. Several other letter abbreviations have been used to refer to CAI. These include: CAL–Computer Assisted Learning; CBT–Computer Based Training; CBI–Computer Based Instruction; and CBE–Computer Based Education.

Advantages and Disadvantages of CAI

CAI offers many advantages. Some research has shown that CAI shortens and enhances learning time. The speed of learning and level of learning are generally determined by the learner. Many CAI programs encourage problem-solving activities with immediate student feedback. Some students who view a traditional classroom as frustrating may find success with CAI. CAI puts these students into a positive learning situation which helps them achieve by taking away some of the pressures found in a traditional classroom. Students tend to like the technology associated with microcomputers.

CAI also has some disadvantages. Rather than planning their own curriculum, some teachers may be tempted to simply turn on the machine, load any available prepackaged software, and allow students to "play." In schools with microcomputers in the classrooms, more than 50 percent of all students are not involved with any type of CAI. Reasons for such low use of CAI include:

- All subjects do not lend themselves to CAI.
- Software may not be available to teach certain subjects.
- Time for teacher development of software is not available.
- Some educators are afraid computers will dehumanize education.
- Some educators are afraid of computers.
- Initial costs of CAI are heavy.

Uses of CAI

CAI has been used for more than 20 years in a variety of ways. Students in traditional elementary, secondary, and college classrooms may have used CAI. Early programs were available in science and mathematics. Increased availability of educational software has helped microcomputers move into classrooms in every discipline. CAI is used in three distinct areas of education: instruction, training, and evaluation.

INSTRUCTION

Instruction generally refers to transfer of information from teacher to student. When a microcomputer acts as a humanoid, instruction transfers from microcomputer to student. Presently educational software is available from textbook companies, software distributors, university or school systems, and individual teachers. Many types of software have been designed for preschool to adult learning levels. Software topics vary from addition and alphabet to zoology and zygotes. Instructional software available for home economics classrooms includes topics from home budgets, to nutrition, to conversions used in cooking, to time management. Such instructional software typically includes topic information and questions for a student to answer.

TRAINING

Training directed by a computer can be found in many post-secondary vocational programs. The microcomputer used in training may be the same type as one used in instruction, but the software will concentrate on job skills.

Much training with microcomputers occurs in the business world. As part of in-service training, employees learn more about their job through microcomputer directed training. Some exampies of microcomputer uses in business are training salespersons, bookkeepers, and medical technicians. Business management software has been developed for company executives.

EVALUATION

Preparation, storage, and administration of tests are still other uses of CAI. Inexpensive test construction authoring systems can be purchased by a teacher. User-friendly systems are available for multiple choice, true-false, and matching tests, as well as for analogy questions and story problem ideas. One such test package allows a teacher to construct and store three-part

multiple choice items. Each item contains a question stem and up to seven correct answers and seven distractors. When ready to use a test, the teacher selects question stems and one correct answer and appropriate distractors for each.

Diagnostic evaluation can also be computer-assisted. Students with special needs can be evaluated with specialized diagnostic software. For example, medical diagnosis is becoming more and more dependent on microcomputers. Pre-testing in on-the-job training may also center around computer evaluation. Even automobiles needing repairs can be diagnosed via a microcomputer. Futurists predict a day when a washing machine repairperson might enter a home, hook up a microcomputer to the washing machine, and diagnose whether it is the timer or the balancing mechanism which needs attention.

CAI Applications

Could computers put teachers out of jobs? Hardly! Computer instruction is merely one of the many instructional methods available for classroom implementation. CAI could be incorporated into a home economics classroom in the following ways:

Housing. Students in your classroom are working on the expense of decorating a home. They could calculate costs by visiting local stores or by checking costs in retail catalogs. However, with a piece of existing computer software, students could compare costs of wallpaper, paint, paneling, and floor coverings. Decision making software programs based on cost factors balanced with personal preferences are also available.

Food and Nutrition. To encourage wise snack choices, you might have a food laboratory experience where students prepare healthful snacks. Or with existing software, students can test their knowledge of snack nutrition on a multiple choice simulation program.

Family Living. To encourage decision making as an individual skill and family decision making as a group technique, students in your classroom might go through a decision making model in small discussion groups. Or, with existing software, they might go through the decision making process with a family simulation which incorporates many facets of family needs.

Consumer Education. While learning the importance of credit in the purchase of a car, students might call local banks and calculate interest rates for the purchase of a used car. Or, they might use financial soft-

ware to calculate interest payments at several rates to see how a small rise in interest rates could affect their purchasing power.

Child Development. Reading readiness skills are often taught in child care centers. Home economics students might prepare educational materials which teach young children reading readiness. Or, they might look at preschool educational software to see the many ways such software can be implemented into preschool reading readiness programs.

Clothing and Textiles. Teaching the elements of design usually requires a large number of visuals, each taking teacher preparation time. A computer tutorial program on the elements of design, complete with color graphics, can effectively teach the material. As each design element is displayed on the computer screen, students can be asked questions to reinforce learning.

Combining Microcomputer Software and Videotapes

Combining the microcomputer with videotape recorder can greatly enhance computer assisted instruction. A videotape recorder can be added to a microcomputer system so that software and a videotape can be used together for a multifaceted learning experience. Sometimes called an interactive instructional teaching station, a student can view videotaped material, respond to software questions by typing answers on the microcomputer keyboard, and receive videotaped reinforcement. Consider the following illustration and scenario:

Interactive Video: A Scenario

Sandy and Pat sit down at an interactive video teaching station in Mr. Davis' consumer education course. They switch on all the equipment. A videotape begins. Sandy and Pat view a short vignette on buying a home. After a three-minute storyline about selecting a new home and financing it, the videotape stops and Sandy and Pat are questioned via microcomputer software to determine whether or not the subject matter presented has been understood. The software program generates a question.

"If a home is approved for VA financi g, must that home meet special building code requirements?"

Sandy and Pat discuss the question and decide their response will be "no." They type "no," which is the incorrect answer, on the microcomputer keyboard and it appears on the screen. The videotape then swtiches back on and Sandy and Pat review the portion of the vignette about VA home mortgages. Had they given the correct response, Sandy and Pat would have viewed a videotaped reinforcement of their response, then seen a different vignette on another aspect of home mortgages.

After responding to several questions and viewing several videotape vignettes, Sandy and Pat receive a short review test. They score 85 percent correct. They receive a print-out of the questions asked, their responses, and a list of possible resources which can help them study the necessary information to improve their knowledge about buying a home.

Such a system seems like something out of the future. Presently expense and lack of educational software/videotape programs make it impractical for most school settings. However, such a system could be very effective for detailed, self-paced, individualized instruction. With high quality videotape productions, interactive video can add realism and relevance to the learning process. Systems like this are used in many management and industrial training situations, in hotel and restaurant management, real estate, automotive maintenance, and nutrition, as well as in engineering, meteorology, and office management.

Computer/videotape instruction is also being used in a variety of other settings. Microcomputer/video systems are used by automobile dealerships to display cars. Because of computer/videotape capabilities, automobile consumers are able to randomly select only the cars they wish to consider. They can

view them being demonstrated on the road, as well as view the interior extras that are available.

Before they are discharged from a hospital, terminally ill patients are being instructed by computer/videotape programs on how to deal with self-care at home. Deaf children are being taught sign language via computer/videotape programs. A videotape camera records deaf children using sign language and they can replay their videotapes for self-evaluation.

CAI Logistics

While a home economics classroom may not be able to afford a microcomputer for each student, strategies for working with a limited number of microcomputers have been tested by many classroom teachers. Selecting a strategy might depend on time allotment, number of microcomputers, students' abilities, and other factors such as teaching style and your computer abilities. The following five strategies are discussed below: total class instruction, timed-used instruction, block time, non-scheduled time, and combination time.

TOTAL CLASS INSTRUCTION

Rather than connecting a microcomputer to a typical 12" videomonitor, use a 21" classroom television monitor placed within easy sight of all students. Or use two television monitors, both connected to the same microcomputer. A teacher or student can enter information into the computer terminal and everyone in the classroom can see the result. When used with individual pencil-and-paper assignments, this technique encourages group participation and individual performance.

TIMED-USE INSTRUCTION

Computer assisted instruction can be effectively blended with other types of individualized instruction. Once software has been loaded into the microcomputer the teacher may schedule each student a given period of time at the microcomputer and set a timer to keep track of that time. Students should have equal amounts of time to work at the microcomputer.

BLOCK TIME

This procedure is especially effective with smaller classrooms, yet can be modified to any classroom. Using a traditional teacher plan book, identify 20-30 minute segments each week when students are able to use the microcomputer in an isolated area of the classroom. Although a lecture in child development may be going on in the center of the classroom, a student might be doing computer nutritional analysis in a corner of the room. Such classroom activities can be very beneficial, but require excellent planning by the teacher. This type of computer lab setting might require complete, self-help instruction books and posters to help students effectively use the software without assistance. Block time schedules can take into consideration students' varying abilities.

NON-SCHEDULED TIME
Student time outside of class (including before school, after school, study halls, lunch breaks, and class sessions which do not fill any entire school period) can effectively be used at the microcomputer. Sign-up sheets can be used to let students know when time is available.

COMBINATION TIME
A combination of time plans can also be used. For example, students might have total class instruction on home budgeting on Monday, incorporate the computer software with other learning experiences for timed-use on Tuesday and Wednesday, and be able to come in during free periods for the last two days of the week.

No matter what CAI technique is used in a classroom, planning and preparation are essential. Posters explaining computer operation could answer questions that might be asked of a teacher. Organizing an area of the classroom for computer activities might provide a working environment for students and keep expensive machinery safe.

Computer Managed Instruction

Chapter 11

Computer-managed instruction (CMI) is the use of a computer to support the management of individualized or group instruction. CMI applications have been viable since the mid-70s and show potential for impact at all levels of education. CMI systems are designed to support certain management functions (such as planning, organizing, or controlling). Some systems are very complex and are used to "direct" entire courses, while other CMI programs aid teachers by saving valuable time in record keeping.

What CMI Systems Can Do

The features of CMI systems vary. CMI systems may perform some or all of the following functions:

- *Collect information.* CMI programs can collect test scores and list objectives mastered, units completed, or resources used. Students can enter their own information, perhaps on a weekly basis, or students can write a short report which the teacher later uses to enter pertinent data on the microcomputer.
- *Store information.* Some CMI programs store curriculum plans, lists of students' names, evaluation instruments, specific evaluation items, or student information. A great deal of information can be stored in a very small space, and lists can be constantly updated without valuable clerical or teacher time. If a student drops a course, it is easy for a teacher to drop a name from a class list. If an occupational student changes employers, no time-consuming re-typing is needed to update records.
- *Diagnose and prescribe.* CMI programs can evaluate pre-test results and place individual students on lists according to learning experiences and ability levels. Colleges have long been using computerized class registration. Microcomputer storage of students' test scores can help a teacher evaluate just where

each student should concentrate study efforts. Lists of laboratory groups, study groups, or work shifts can be stored and changes can be easily implemented.

- *Process student work*. CMI programs can organize and summarize students' work, including worksheets, lab scores, quizzes, and test items. Students can either do their work at a microcomputer and enter scores to a program, or the work can be done on paper by the students, and can be graded and entered on a grading program by the teacher.
- *Report*. The computer can average students' grades, prepare item analysis of evaluation items, and inform students (and parents or employers) daily or weekly of their progress. Such a program can tailor-make progress reports for parents. In addition to reporting a single letter grade for a grading period, a computer could quickly generate a report of work completed, objectives reached, and individual grades on each scored worksheet, lab, quiz, or exam. Group norms can be generated to use for comparisons for individuals.

In some cases CMI is a total educational approach in which a computer monitors the teacher's management. Some of these possibilities include:

- Administering a 10-point quiz to students following a lecture or class discussion. Students see their strengths and weaknesses and lecturers or discussion leaders receive data to help them evaluate their teaching.
- Allowing students to choose from three or four course objectives. The computer directs their learning so that specific objectives are reached.
- Pre-testing students to diagnose their learning level.
- Allowing students to check their progress daily including giving them an up-to-the-minute grade average.

Implementing CMI in the Classroom

Characteristics of CMI make it feasible for many school settings. The necessary computer hardware is already available in many schools. The types of computers found in many schools will adapt to CMI and nearly all the technology necessary is attainable for home economics classrooms. CMI allows a teacher to program learning to suit varying student interests, learning styles, and abilities. The advantages and disadvantages of CMI are listed in the box below.

COMPUTER MANAGED INSTRUCTION

Advantages	Disadvantages
Makes effective use of teacher time by reducing teacher paperwork	Requires necessary hardware and software
Improves recordkeeping	Requires adequate funding

Advantages	Disadvantages
Improves evaluation by basing it on concrete criteria	May or may not be visable to students
Graphically shows students' progress	May not be possible if school district finances computers for student use only
Supports programs through accountability	Is time-consuming to plan and implement
Generates simple statistical analyses	May be disliked by some in a school who feel it depersonalizes instruction
Professionally represents your classroom to students, administrators, and parents	May be disliked by other teachers who are not as organized

Some CMI programs have been developed to help teachers in classroom settings. Many of these have been used by teachers at the university level for several years, but only with the development of microcomputers and microcomputer software have these methods been available for most secondary teachers. Educational software vendors have many programs designed to aid teachers. Some of these ready-made programs include:

- A data base, actually a file that can be used to keep track of student information. Teachers might file resources, test questions, or lessons for students needing remedial work or make-up work. Cooperative education teachers might use such a program to keep track of employment records or individualized instruction.
- A grading program which can keep track of student grades as well as weigh scores. One teacher reports that semester grades for 117 students can be processed in seven minutes. Once the data are entered, not only are individual scores calculated, but also basic statistical treatments can be applied to determine group norms.
- Roster programs can generate up-to-date lists for sections, lab groups, or study partners. Should a student drop a course or change sections, a completed, up-to-date list can be printed in only a matter of seconds.
- Accounting programs for student organizations will generate monthly reports, plan budgets, and keep track of activity funds.
- Mailing lists can keep up-to-date alumni files and student organization lists. If you need to promote summer homemaking, you can send everyone on the list a letter about it.

Teacher utilities are not part of what is generally defined as CMI but they can help a classroom teacher manage a class. Some teacher utility packages will design tests, quizzes, crossword puzzles, and wordfinds. Other programs include equipment inventories, statistical packages, and readability calculations.

Developing CMI

Self-developed CMI programs can re-structure a classroom. Such changes require programming skills and plenty of patience, but the rewards are tremendous. Imagine that you are the teacher in the following scenario:

CMI: A Clothing and Textiles Scenario

You are teaching a clothing and textiles semester course to high school juniors and seniors. You have spent more than one year developing the course. You have introduced your students to the microcomputers scattered throughout the clothing and textiles laboratory.

WEEK 1, DAY 1: Students are given a computerized multiple choice pre-test on clothing contruction techniques, textile science, clothing maintenance, and consumer buying.

DAY 2: Each student receives a print-out showing total score and item analysis of test questions to indicate areas of expertise. You receive detailed reports of each student's score, plus class averages and an item analysis for each pre-test item.

DAYS 3-5: Students select and alter patterns and plan shopping trips using the computer.

WEEKS 2, 3, and 4: Students are directed to lessons individually based on pre-test scores.

As a student works on each lesson he or she begins with measurable objectives. Each student is given learning experiences to work through along with resource lists.

Let's look over Bill's shoulder as he works on a unit in consumer buying of clothing. This unit deals with characteristics of well-fitted garments.

First he reads the objectives. They are listed on the computer screen as shown below:

After completing this unit the students will be able to:

1. Improve perceived body proportions through clothing selections.
2. Choose flattering colors for skin, hair, and eyes.
3. Plan a basic wardrobe.
4. Accessorize garments creatively.

Bill selects Objective 3 and chooses one of seven learning experiences which can help him plan a basic wardrobe.

He selects Learning Experience 4 which asks him to study men's fashion books and magazines and to identify classic styles which have remained popular throughout the past 50 years. He will choose six clothing items on which to build a wardrobe suited to years of wear.

WEEK 5: Bill has worked through several objectives and many learning experiences. He can now sit down at the computer and ask for review questions to help him study for his unit test. All along he has been completing assignments and getting scores from quizzes.

WEEK 6: Bill has an average score of 87 based on his assignments and quizzes. He feels this score is very good and he hopes to maintain his B+ average through the exam.

Bill takes the exam, based only on his previous choices of objectives. His exam questions are individualized and relate specifically to the work he completed during the past six weeks.

At a computer next to Bill sits Maria who is also completing her very specialized unit on household textiles. She has done well and hopes her background will help her with her new part-time job in a drapery business.

Another student, Julie, has completed construction of a blazer. She is being tested on pocket, lapel, lining, and interfacing construction techniques.

James, yet another student, is taking his exam on recycling clothing, while other students are being tested on sewing and pressing equipment, altering ready-to-wear, selecting children's clothing, designing clothing, and understanding the apparel industry.

Can you believe you were teaching all those topics to all those students who had varying abilities and needs? You can—if you use computer managed instruction.

Computers and Special Needs Students

Chapter 12

The computer holds unique promise in the education of special needs students—the gifted and talented, academically disadvantaged, English language limited, hearing impaired, speech-impaired, blind, physically impaired, and mentally handicapped. For special needs students, the computer can communicate, teach, challenge, and even control the environment. It can aid the handicapped individual in personal management. It can aid the teacher in planning, developing, and implementing educational plans for individual special needs students.

Computers for the Gifted and Talented

The computer is a particularly effective tool in educating gifted students. It can be used to teach students more advanced materials. It can be used in independent study. It can encourage gifted students to explore more about the future effects of computers on their lives.

Because many gifted students already have an interest in a variety of subjects, computers can be used to encourage gifted students to "probe" further into specialized subjects. For example, gifted students can select and enter needed words and clues into educational games which allow changes. While the gifted students do research about what to enter into the games, other students can study the material in more usual ways and then use the games as a review. Gifted students who know programming can also write programs for home or class use.

A variety of computer applications are possible with gifted students. The graphics capability of microcomputers may hold special interest for some gifted and talented students who can use graphics to bring life to textbook topics. Computer assisted instruction (CAI) can be used to allow gifted students to move

at their own pace through established content, to encounter it in greater "depth" by addressing higher level cognitive objectives, and to obtain instruction in content areas not required of all students. Computerized educational games played against the computer or against another student could provide added stimulation for gifted students. Simulations which allow students to make decisions allow gifted students to learn principles which govern the operation of the simulated system. This occurs through processes of decision making hypothesis generation, and testing.

Computers for the Academically Disadvantaged

Academically disadvantaged students can have positive learning experiences with microcomputers. In fact, teaching disadvantaged students can be enhanced by the use of microcomputers because these students may not have access to microcomputers in other classes. The benefits of color graphics, sound, and repetition can be helpful to any student but are particularly suited to disadvantaged students. Much software primarily teaches home economics content, while at the same time it reinforces reading, spelling, and mathematics concepts. Reinforcement, frequently included in software, can be very helpful to encourage productivity in disadvantaged students and, according to some teachers, can lead to success in other classroom activities.

Computers for Those with Limited English Proficiency

Students with limited English proficiency can profit from microcomputer use. Many programs use lowered reading levels to teach higher grade level concepts. As a teacher, you should select some pieces of software for students who have lesser reading abilities. Software most suitable for students with reading difficulties should include short sentences, definitions of key terms, and plenty of time for students to read the material presented on the monitor. Repetition can be helpful to reinforce learning and many programs contain repetition. Many software programs, geared at preschool age children require no reading and could be used to introduce students to microcomputer use. A final advantage of microcomputers for students with reading difficulties can be color graphics and sound. Software using these techniques to encourage learning should be selected.

Computers for the Physically Handicapped

Microcomputers have made possible the invention of new devices to aid the handicapped in communicating and in gaining new self-sufficiency. Hearing impaired, speech impaired, blind, and physically impaired individuals are all benefiting from new applications of computers. Computer technology is providing handicapped persons with a new tool through which learning can take place. Although many specialized computer devices are still in the experimental stage, they show real promise in

eventually lessening the effects of handicapping conditions. While it would be unrealistic to expect a computer to solve all of the problems of a handicapped person, it is reasonable to expect the computer to solve many of them.

HEARING IMPAIRED

Computer technology is especially beneficial to the hearing impaired. Computer assisted instruction (CAI) allows deaf students to receive instruction which is *not* dependent on speaking and hearing. The interactive nature of computer assisted instruction is a valuable aid in instructing hearing impaired students. CAI has been used successfully to teach deaf learners language, math, and other skills. Animation and graphics can be used to add interest to CAI programs used with deaf students.

Other computer applications also benefit hearing impaired students. Some teachers report that "electronic mail" is a technique that motivates the deaf learner to write more often, and believe that it may improve the writing skills of deaf students. Combined use of videotapes and computers create infinite possibilities for meeting the needs of deaf learners. For example, use of computer-controlled random access videodisks could allow simultaneous use of captions and audio-video material in the mainstreamed classroom.

Various attempts are underway for using computer technology to help the deaf "hear." At Stanford University, researchers have developed a "bioear" which may eventually provide rudimentary hearing to profoundly deaf individuals. In this application, a small disk which contains a microprocessor is implanted behind the individual's ear. It receives sounds and converts them into a series of impulses which are then passed to the brain via the auditory nerve where they are interpreted as sound. Research is also underway to perfect a computer-based system to allow deaf individuals to "see" speech by portraying it graphically.

SPEECH IMPAIRED

Speech synthesizers and speech digitizers are enabling persons with impaired speech to communicate with those around them. Rapid advancements in artificial language may soon enable many individuals who are unable to speak to communicate in a near-normal manner. In addition, microcomputers can greatly accelerate the speed with which such individuals can communicate by use of abbreviated commands. These commands could permit creation of sentences or paragraphs with only a few movements. In the future, the computer may be able to anticipate input based on previously used patterns of words or information. Morse Code or other codes could also assist in communication. Electronic symbol boards have been developed to assist individuals who have a restricted range of movement to communicate effectively by touching the desired symbol. Some speech impaired persons are using light pointers and laser

devices to input information to microcomputers which, in turn, communicate the information to others.

VISUALLY IMPAIRED

Microcomputers make it possible for individuals with limited vision to be presented material in large print. A computer system can allow a blind person to give oral commands to the computer, then receive a response in computer-generated speech. Another aid for the blind is a device which translates print to tactile stimulation. A silent electronic Braille reader/writer is another communication aid. A machine is even available for the visually handicapped which can convert most English-language magazines, hard cover books, and material written on standard typewriters into spoken English (synthetic speech).

PHYSICALLY IMPAIRED.

As an educational medium for physically impaired students, the computer offers new hope, new independence, and new opportunity for lessening the gap between what they can and cannot achieve. Some physically impaired students can learn to use a regular computer keyboard by using one-hand touch typing. Even if the severely handicapped person is unable to use a keyboard to enter data into a microcomputer, a head switch, knee switch, foot switch, or other device can be used. In such a case, a switch can be designed to match whatever muscle the person can control with accuracy.

Microcomputers are being used to develop communications systems for persons who cannot speak and who have only limited muscle control. Such a physically handicapped person can use a computerized communication board to build sentences on a display screen. A printer can provide a permanent copy of what the person says. One promising system utilizes a speech synthesizer to enable the person to communicate. This method of communication is much faster than the manual communication boards previously used by handicapped persons.

Voice recognition units may be used by individuals who possess speech but lack sufficient range of movements to successfully use microcomputers. Some work is also being done to enable the computer program to recognize hard-to-understand speech and convert it to either artificial speech or to print.

Computer controlled devices can aid the physically impaired in controlling their environments. A sophisticated environmental control system can permit a person with disabilities to control lights throughout the house; turn radios, TV sets, and stereos off and on; answer and dial telephones; operate coffee pots, toasters, or broiler ovens; raise and lower electric beds; send out alert signals in case of emergency; and even turn the pages of books. Such a system, operated from a single control module, can be activated by one finger or by mouth.

Computer technology is restoring abilities the physically handicapped person has lost. Thanks in part to microcircuitry, the physically handicapped person may be able to operate "electronic arms" by nerve impulses on the skin, rather than by the previously more complicated array of straps and levers. With this device the individual can control the opening and closing of the hand to pick up a pencil or pen. In another recent development, a microcomputer has been used successfully to control electrical stimulation of selected muscles to permit a young woman who had lost the use of her legs to "walk" again. The use of robotics to perform complex tasks to extend the capabilities of the physically impaired is also possible. All of these applications can enable the physically impaired individual to lead a more normal life.

Computers for the Mentally Handicapped

Another group to benefit from microcomputers has been the developmentally disabled or mentally handicapped. Individualized instruction has been shown to be an extremely effective means of providing instruction to mentally handicapped learners and through computer assisted instruction (CAI), computers present a viable means of providing such instruction. CAI has been used to teach vocabulary, reading, math, language arts, visual discrimination, motor skills, money management, time management, travel skills, and more. The computer can present small, systematic units of materials; provide repetition as required by the student; and provide immediate feedback. However, much work remains to be done.

Combined use of the microcomputer and videodisk offers new possibilities for educating mentally handicapped students. Used together they could allow the mentally handicapped student with limited reading skill to interact nonverbally with the system by simply touching the monitor screen.

Personal Management

In addition to compensating for physical limitations, the microcomputer is a valuable aid to the handicapped individual in the management of personal affairs. Tasks which may take the nonhandicapped individual only a few seconds may require a considerable amount of time for a handicapped person. Some tasks which the microcomputer can make easier for a handicapped person include:

- *Word processing.* The handicapped person can use the microcomputer to communicate, correspond, keep records, or make notes.
- *Filing and retrieving information.* The physical dexterity needed for manually filing and retrieving information can be a problem for some handicapped persons. The microcomputer can provide valuable assistance.
- *Managing personal finances.* The microcomputer's speed and efficiency in recording, calculating, and organizing financial

records is especially beneficial to persons who have restricted range and speed of functioning.

- *Shopping and banking.* The advent of such services will help the handicapped lead more normal and independent lives.
- *Obtaining and communicating information.* Linkages to various data bases and libraries are already enlarging the horizons of handicapped individuals who may not be able to easily leave their residences.
- *Providing entertainment and recreation.* These activities are vital to the handicapped as they are to the non-handicapped.

Telephone companies in the Bell System provide special services for disabled people to aid customers with impaired hearing, speech, vision, or mobility. Consult the index of your telephone directory for "Special Services for Disabled People" or call your local Bell business office. For people with impaired hearing or speech, special services may include: portable teletypewriter, volume control handset, tone ringer, bells in many frequencies, artificial larynx, signaling, and telephone adapter. For people with motion impairments, special services may include: Touch-Tone Service, Touch-a-matic telephone, speakerphone, and custom calling services.

Computer networks allow physically disabled individuals to send and receive letters, interact with computer programs on a larger computer system, receive information from the UPI wire service, and more. In addition, the computer can be used to communicate with other handicapped persons with similar computer systems via the telephone modem.

Educational Applications

Microcomputers are increasingly being used to develop and manage the required Individualized Educational Plans (IEPs) for special needs students. The microcomputer can be used as a diagnostic tool to assess the handicapped student's educational strengths and weaknesses.

Not only can the microcomputer provide assessment information, it can help prescribe the needed education. Once the student's needs have been established, the microcomputer can, with proper programming, identify and specify curriculum objectives, methods, and materials and instructional formats best monitor student progress toward specified educational goals and objectives.

The teacher can use the microcomputer to evaluate and develop materials for individual special needs students. The teacher can quickly enter reading material and obtain a variety of readability analyses. These analyses help the teacher select or adapt material to meet the needs of individual students. Preparation of individualized materials can be greatly accelerated by using the microcomputer as a word processor. The computer can also be

used to store, retrieve, and organize the information needed for preparing reports on the progress of special needs students.

Microcomputers offer special benefits in the delivery of instruction to handicapped students. One particular benefit is the ability to repeat information over and over until the student over-learns the material. This technique has been recognized as beneficial for learning factual information. Well-written tutorial programs meet individual needs of students by including various levels of instruction covering the same topic. Some simulations enable students to practice or demonstrate skills, to assess the student's competence in a given area, or simply to encourage discovery. The microcomputer can also be used as a tool to improve handicapped students' functioning in the classroom through use of word processing and information and retrieval capabilities.

Three distinct advantages result from using the microcomputer with handicapped learners.

- *Individualization*. Self-paced computer programs allow the learner to cover the material as rapidly or as slowly as needed and to review at will. The appropriate level of instruction is also possible. In addition, feedback for correct and incorrect responses can be tailored to fit the student. Finally, multisensory learning, especially beneficial to some handicapped students, can be provided.
- *Motivation*. The self-paced aspect of software motivates some students. The non-judgmental nature of the computer motivates others.
- *Interaction*. The microcomputer provides students with immediate feedback regarding their performance. This keeps the handicapped learner from "practicing" the wrong response until the teacher can provide feedback. Microcomputer programs can be personalized and humanized to help the learner relate better to the material. Materials can be written so that they actually communicate with the learner.

Computer applications for special needs students have not nearly reached their full potential. Exciting developments for this audience should occur for years to come. Current computer magazines can help you stay abreast of the latest developments. As a home economics teacher, you can help handicapped students learn about computer applications which can improve the quality of their lives. You can also use microcomputer technology to provide instruction for the special needs students in your classroom.

Software

Chapter 13

According to *Consumer Reports,* some 20,000 different programs have been designed for microcomputers. Teachers must sort through all of these options to select software to assist in classroom instruction. While this selection process can be frustrating, appropriate software can add an important new dimension to the home economics classroom.

Introduction to Software

Software refers to step-by-step instructions that tell a computer what to do and how to do it. These step-by-step instructions are also called **programs**. Writing these instructions is called programming, and the people who write them are called programmers.

However, one does not need to write programs to use a computer. Much pre-programmed software is available and aims to be **user-friendly**. User-friendly means that a person unfamiliar with programming skills can use "prompts" within the program to add in necessary information to use the program without ever working directly with the programming.

Ready-made software programs are purchased to fit the computer system for which they were designed. Matching software and hardware requires the match of several factors. First, software is labeled according to compatibility to make and model of computer. Before purchasing software, match it directly to the make and model of the computer for which it will be used. Software programs are available for use with different microcomputers in disk (hard or soft), cassette, and cartridge formats.

Educational Software

Three types of educational software (courseware) are popular and have begun appearing in home economics classrooms. These include: **drill and practice**, in which students use electronic workbooks with many questions to answer; **tutorial** programs, in which students get information and are asked questions about the information; and **simulations**, in which students respond to questions about "real world" situations.

Some teachers who are more experienced in computer use may choose an **authoring** system. This software system allows teachers to type their own educational materials into a programmed framework.

For vocational programs, adaptations of business and home software can add to classroom experiences for students. Such software includes **spread sheets**, which store and analyze financial records, and **word processing** programs, which are valuable for generating letters and reports.

Many types of educational courseware can benefit a classroom, but the proper selection according to type can add to the benefits. Knowing the advantages and disadvantages of each type is important to courseware selection.

DRILL AND PRACTICE

Drill and practice is one of the most common and best known forms of educational software. Its purpose is what the name implies. Students are presented a concept repeatedly until, through repetition, the information is retained by the student. Drill and practice software packages are merely workbooks transformed into electronics.

Immediate feedback distinguishes a drill and practice software package from a workbook. Immediate feedback offers advantages to both student and teacher. It helps students know when they are right or wrong with less possibility of learning material incorrectly. It eliminates some routine paper grading for the teacher, and with some programs, gives a summary of the student's performance. Students who master the material quickly are directed to more difficult questions and those who can't correctly answer the questions are directed to simpler problems or additional resources, such as textbooks or audiovisuals.

Does this program sound like an ultimate teaching technique? Perhaps, but drill and practice also has limitations. The chart on the following page lists some advantages and disadvantages of drill and practice programs.

DRILL AND PRACTICE	
Advantages	Disadvantages
• Replaces flashcards, worksheets, and workbooks • Tailored to individual students • Provides reinforcement following each response • Eliminates problems that develop when teachers become tired and grumpy • Involves active student participation	• Programs tend to be narrow in scope • Repetition can be monotonous to some students • Student/teacher interaction is limited • Teaching is often only at the knowledge level

Multiple choice questions are quite common in drill and practice software. Many drill and practice software packages are available in food and nutrition and consumer education. For example, some programs help students learn metric conversions and others aid in learning recipe doubling. The questions below are typical of drill and practice software.

SAMPLE DRILL AND PRACTICE QUESTIONS

1. Which of the following is an excellent source of Vitamin C?
   - A. whole grain bread
   - B. strawberries
   - C. green beans
   - D. milk

The student responds: B

The computer responds: "That's right." "Try the next question."

2. Which of the following is a deficiency disease of protein?
   - A. kwashiorkor
   - B. pellagra
   - C. scurvy
   - D. rickets

The student responds: C

The computer responds: "That's incorrect." "For more information on protein deficiencies see page 83 in the textbook."

TUTORIAL

Tutorial programs involve the computer as a humanoid and function much like a tutor in a one-to-one teaching situation. However, the computer is not human. There are times when a computer acting as tutor is better than its human counterpart, the teacher. Tutorial programs don't get tired of repetition.

Tutorial programs are generally able to stand by themselves without other instructional materials. While drill and practice programs may use questions discussed in a lecture or classroom discussion, tutorials include all the information required for teaching subject matter. Therefore, they are ideal for teaching very specialized subject matter. Tutorial programs are also suited to independent learning.

Many tutorial software packages have been designed for classroom use. Some are available in home economics content areas and more are being developed. The chart below lists advantages and disadvantages of tutorial software programs.

TUTORIAL	
Advantages	Disadvantages
• Material is presented at learner's pace • Student level is diagnosed and learning pace is adjusted • Computers *can* be more patient than a teacher • Graphics can enhance learning • Programs can be adapted to remedial or advanced study	• Questions may be at knowledge or comprehension level • Students may read materials only to answer questions, rather than to learn material

Below is a sample tutorial question. The student is given some information followed by a question or set of questions based on preceding information.

SAMPLE TUTORIAL QUESTIONS

Measure for Measure

To be sure of success in the kitchen, accurate measuring is vital. A recipe lists exact amounts of ingredients, usually given in U.S. standard measures. Knowing how to measure ingredients, both wet and dry, will help you get consistent finished products.

If: 3 teaspoons = 1 tablespoon
16 tablespoons = 1 cup

Then: How many teaspoons are in one cup?

A. 14
B. 70
C. 48
D. 45

The student responds: C

The computer responds: "You are correct. Proceed to the next question."

SIMULATIONS

Allowing students to play a role in a situation is the main feature of simulations. **Simulations** are models or descriptions of complex situations. Rather than stimulus-response modes, such as those used in drill and practice or tutorial programs, simulations allow decisions to be made by a student. These decisions are based on information given in the program and on the student's values and knowledge. Simulations allow students to give unconventional responses and see the consequences without worrying about real consequences.

Many simulations fit home economics classrooms. Students can calculate prices of homes, including varying interest rates, taxes, and insurance. In other applications, students can form a food service corporation, run a clothing store, or plan a family budget.

Simulations bring the real world to the classroom. The cost of taking students out of the classroom for field trips and observations has increased dramatically in recent years. Students who learn a skill in a simulation can later transfer that skill to a "real world" situation. The chart below lists some advantages and disadvantages of simulations.

SIMULATIONS	
Advantages	Disadvantages
• Encourages development of divergent thinking • Brings the real world to the classroom • Provides inexpensive "real world" experiences • Allows students to experiment with unconventional responses.	• Can be very time consuming classroom experiences • May be oversimplified to the point of inaccuracy • Cannot provide enough alternatives to be realistic in many situations.

Simulations tend to be long programs and, therefore, long classroom learning experiences. However, if simulations are properly introduced and students are asked to make closing generalizations, simulations can be particularly effective. See the sample simulation on the following page.

SAMPLE SIMULATION

Hot Dog Haven

Your cousin Howard died and willed you his hot dog stand. Your business decisions may help you finance college. Since you really want to attend college, making extra money is very important to you.

The weather in Sundale is lovely today. Many people are out strolling. You sell 17 hot dogs and wonder what you can do to increase sales.

Painting the hot dog stand will cost $8.25 for paint and one day's labor for you. You decide to spruce up the stand with hopes it will increase business.

The next day you announce a two-for-one sale. You sell 46 hot dogs at a meager 1.2 cent profit per dog.

The following day you return to regular 65 cent hot dogs You sell 18 for a 34 cent profit per dog.

Marketing seems to be the name of the game. What alternative do you select?

A. Reduce prices to 50 cents each (a 16 cent margin)
B. Add chili and cheese; raise prices to 75 cents each
C. Purchase advertising in a local newspaper
D. Consider moving two blocks closer to the baseball stadium

The student selects Alternative B.

One ounce of canned chili and 3/4 of an ounce of cheese adds 9 cents to the price of a basic hot dog. In order to maintain a profit, you need to increase sales and increase prices. You must increase prices to 75 cents per hot dog.

Advertising your new product seems to be the best way to increase sales. Which do you choose?

A. Advertising in local newspaper; $45 for one week
B. Advertising on local radio station; $75 for four days
C. Print signs for $12.50 and place around your stand
D. Distribute $20 worth of handbills to neighborhood

The student selects a course of action from the list above and the simulation continues. Other factors presented in this simulation could be changes in weather and its affect on people eating out, an influx of tourists for a baseball tournament, and changes in the local economy when a paper mill lays off more than 400 employees.

AUTHORING SYSTEMS

Computer authoring systems are new tools for classroom teachers. Programming a computer in any language requires time and practice. Using an authoring system provides the flexibility of programming and saves teacher time and energy. Authoring systems are designed to make it easy for teachers to put their own educational materials into an already existing framework.

Many authoring programs have been designed specifically to aid classroom teachers Various authoring systems will:

- Calculate students' grade averages
- Produce multiple choice quizzes and tests
- Construct crossword puzzles
- Make bingo cards for vocabulary review
- Calculate textbook readability
- Write case studies
- Construct word scrambles

More complex authoring systems will help you set up simulations, tutorial programs, and drill and practice programs for classroom instruction. For example, if you can't find a software package to help your institutional foods students learn kitchen sanitation, an authoring package can help you develop your own.

Authoring languages give teachers the ability to individualize instruction, so only what is important is included in a program. Just as you tailor a lesson plan to the specific needs of your students, authoring languages help you write programs to individualize software. The chart below lists some advantages and disadvantages of authoring systems.

AUTHORING SYSTEMS	
Advantages	Disadvantages
• Can be used by people without computer programming training • Many are easy to master • Systems may ease classroom teacher's workload • Useful for subjects with limited available software	• Easy-to-learn languages lack flexibility • Some languages execute slowly • High cost • May have limited storage capabilities • More sophisticated authoring languages are difficult to learn

SPREAD SHEETS

Electronic **spread sheets** are programs to help record finances. While they can't balance an overspent departmental budget, they can serve as an efficient way to record weekly or monthly expenses in a chart of accounts. Still other spread sheet pro-

grams allow the user to play "what if," testing hypothetical figures. "What if the house price were $47,000 and the mortgage interest rate were 12.5 percent?" and "What if another house were priced at $53,000 and has an 11 percent mortgage interest rate?"

Microcomputers have proven their worth in business because of simple, available software which allows a user to bill clients, prepare a budget, analyze cash flow, and prepare profit/loss statements. Students in occupational classes who gain experiences with such spread sheets may find the skills gained useful in home economics-related jobs.

Spread sheets differ from the very simple to the very complex. Some are used in consumer education to show students how to balance a checkbook. Others designed for business applications produce graphic representations (including pie graphs, bar graphs, and X-Y graphs) for financial representation. The chart below lists some advantages and disadvantages of electronic spread sheets.

SPREAD SHEETS	
Advantages	Disadvantages
• Organize financial data quickly • Produce financial reports • Many software programs available	• Require tedious entry process • Programs must be selected for specific needs

WORD PROCESSING PROGRAMS

Word processing software with the aid of a printer can turn a microcomputer into a sophisticated typewriter. If producing papers and other written materials is important in your teaching, investing in such a program may be very valuable to your department.

When using **word processing software**, the typed words appear on a video screen. The author can then correct words, delete words, move lines or paragraphs, or correct punctuation. Once the author is satisfied with what is written, a simple command is used to transfer the information to hard copy (a print-out).

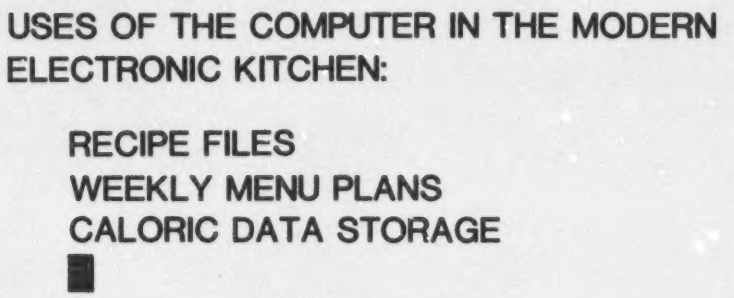
The numerous word processing programs available provide many options. Prices range from $40 for a relatively simple program to more than $500 for word processing capability suitable for a business office. A relatively modest program will generate letter and school reports.

Purchasing a word processing program might be viewed much like purchasing a car. Some features, such as a car's motor, are

essential, while others, such as air conditioning, may be more important to one person than to another. Many options are available in word processing software.

One essential function is writing and editing. As you type, letters are seen on the screen. A cursor, a dot of light, indicates where you are in the text. You can move the cursor back two or three spaces, two or three lines, or two or three paragraphs to add, delete, or change a word, sentence, or paragraph.

The cursor aids the typist in knowing exactly where changes are to be made. The drawing below shows how a cursor looks in a text:



Simple cursor controls move one letter forward or backward as commanded. Some cursors can jump lines or paragraphs for rapid editing. Just how a cursor moves depends on the program and available hardware. One method uses arrow keys on the keyboard to move the cursor up, down, left, and right. Some keyboards do not have arrow keys and use ordinary letter keys instead to move the cursor. The amount of word processing you anticipate might influence your choice of keyboards.

Various word processing options are available. They include:

- Scrolling—moving the text up and down
- Deletion of a letter, word, line, or paragraph
- Insertion of a letter, word, line, or paragraph
- Search and replace—locating and replacing a misspelled word throughout the text
- Save—type is stored in computer's temporary memory (RAM). This is a precaution against losing the content when the machine is turned off or the current is interrupted.
- Justified margins
- Hyphenation of words
- Automatic pagination
- Centering
- Subscripts
- Superscripts
- Bold face
- Spelling check

Beginning a Software Library

Chapter 14

A simple software cataloging system will help the home economics teacher choose and use computer programs for classroom instruction and management. This chapter discusses software selection, evaluation, storage, and cataloging.

Selecting Software

Computer-assisted instruction is a learning event. All such learning events (like brainstorming or a foods laboratory or computer-assisted instruction) include many steps, each leading to an increase of knowledge for the student. Just as a teacher's lesson includes objectives, content, learning activities, and evaluation, so does software for computer-assisted instruction. The following chart compares the steps in a traditional lecture with a computer tutorial program.

STEP	LECTURE	TUTORIAL PROGRAM
1. Gain attention	Teacher establishes set with an anecdote, transparency, or well-planned probing question.	Graphics, color, and sound may attract some students; independent learning itself may interest others.
2. State objectives	Teacher may say, "In today's lesson we will study . . . ."	Computer presents a list of learning objectives.
3. Stimulate recall of prerequisite learning	Teacher may say, "You may remember in yesterday's lesson. . . ."	A short pretest is given to check knowledge and familiarity with materials.
4. Present material	Teacher may illustrate lecture with transparencies, by writing on a chalkboard, or with other materials.	Content material is presented along with many graphic representations to aid learning.

STEP	LECTURE	TUTORIAL PROGRAM
5. Guide learning	Teacher may give examples, show visuals, ask questions.	A series of information and questions is presented about the topic.
6. Elicit performance	Students complete worksheet on topic. All answers are turned in to teacher.	Student responds to questions presented on monitor. Computer coaches and points out wrong answers so student can relearn.
7. Provide feedback on performance	Teacher grades and returns papers to students the next class period.	Students receive immediate feedback as to right and wrong answers. Students can begin to relearn material, if needed.
8. Assess student performance	Student receives grade.	Student receives grade.
9. Plan for next lesson	Based on student performance, teacher evaluates each portion of the teaching-learning process and makes plan for reuse of material.	Based on student performance, teacher evaluates each portion of the teaching-learning process and makes plans for reuse of material.

Teachers can evaluate the steps of a computer software package just as they can assess their own teaching. Does the lecture include each of the nine steps listed above? If so, the teacher is probably doing a good job of teaching. Does the software cover steps 1-9? If so, it is probably doing a good job of teaching.

Selecting software is more challenging than selecting a traditional instructional method because many considerations limit software choice. One of the most important limitations is available hardware and software. In many cases, a teacher may be selecting hardware as well as software. The information below includes some tips on software selection for teachers who will purchase both hardware and software at the same time.

Starting From Scratch—Which Comes First?

The most important factor to consider when purchasing software is its compatibility with a microcomputer system. It must fit all the memory potentials and peripherals of a system—exactly matching the make, model, memory capacity, and disk/cassette storage option.

If a microcomputer is already in place in a department or school, software which is compatible to this system must be purchased. If a department or school is starting from scratch and selecting both hardware and software, a thrifty teacher might examine both software and computer hardware before selecting either.

You cannot use every cassette or disk with every computer. Even when they use the same language (BASIC is common for many microcomputer programs), variations in format often limit software programs to the computer model for which they were designed.

Buying software is often compared to purchasing a record album or audiocassette. Although a computer disk or cassette look similar to their cousins, the record album and audiocassette, the programs for microcomputers are much more complex and are not easily used on just any microcomputer.

The cassette tapes that hold readymade programs are physically the same for all computers which use cassettes as memory. But these cassettes will not run on just any microcomputer. The rate at which data are transferred from tape to computer varies as well as the rate of decoding of the taped material.

Many microcomputers have been designed for a specific audience (such as small businesses, homes, younger children) and software aimed at these same audiences is available. Knowing many available sources of software can help any teacher maximize computer learning.

SOFTWARE SOURCES

Software shopping can be very time consuming. Many software programs are available and many educational software catalogs list software adaptable to home economics classrooms. Teachers will find few sources directed only to home economics. They must look at software marketed to other departments such as mathematics and business (consumer science), science (nutrition and textile chemistry), and general areas related to occupational preparation (employability skills).

Software reviews may be useful to teachers contemplating software purchases. Home economics publications such as *The Journal of Home Economics, Home Economics Research Journal, Forecast for Home Economics, The Illinois Teacher of Home Economics,* and *Tips and Topics* all include articles on home economics uses and adaptations of software. Many articles center on experiences of teachers using software in their classrooms. Several educational computer publications are available including *The Computing Teacher, Educational Computer Magazine, Classroom Computer, Educational Technology,* and *Electronic Learning.* Regional Educational Service Centers in Texas may be able to provide help with software selections.

Other sources for information about educational software include:

Association for Computing Machinery
1133 Avenue of the Americas
New York, NY 10036

Association for the Development of Computer-based Instructional Systems
c/o Computer Center
Western Washington University
Bellingham, Washington 98225

Division of Educational Technology
Office of Educational Research and Improvement
U.S. Department of Education
Washington, D C 20202

Educational Software Catalog
Scholastic Software
22 East Quakenbush Avenue
Dumont, NJ 07628
(free–specify for Apple, PET, or TRS-80)

ERIC Clearinghouse on Information Resources
Syracuse University
130 Huntington Hall
Syracuse, NY 13210

Micro-SIFT
Northwest Regional Educational Laboratory
900 SW 6th Avenue
Portland, OR 97204

Softswap
c/o Ann Lathrop, Library Coordinator
San Mateo County Office of Education
333 Main Street
Redwood City, CA 94063
(*offers more than 250 public domain instructional program for loan*)

BUYING SOFTWARE

Software programs are available from many sources–some private and some public. More than 200 independent software dealers sell software through catalogs. Addresses of software dealers can be located in most educational computer magazines. Many educational, audiovisual, and textbook companies now sell software. Many schools and universities and state Cooperative Extension Services have software available for use and/or sale.

No matter where software is purchased, shopping tips can be helpful. Some software shopping tips are listed on the following page.

Shopping Tips For Software

1. Examine your present needs.
2. Project future needs.
3. Prioritize needs.
4. Know school/departmental budget and set a price range.
5. Talk to other professionals about software they have used or examined.
6. Keep a file of their comments, reviews from computer magazines, professional journals, and your evaluations.
7. Talk to local computer dealers.
8. Contact software dealers directly, using computer magazines to locate addresses.
9. Evaluate the program's manual (documentation) using your course objectives as a guideline to determine if materials are suitable for your classroom.
10. Ask to see the software demonstrated.
11. Keep in mind that a salesperson may or may not know much about the software and that *you* know much more about how *you* plan to use it in *your* curriculum.

Other considerations are also important in selecting software. To be best suited to home economics classroom use, software should:

- Be free of technical or pedagogical errors
- Take advantage of the computer's unique capabilities
- Provide positive reinforcement and, at the same time, help direct student to correct answers
- Include some diagnostic features
- Branch to aid in keeping pace with a student
- Stimulate creativity among users
- Allow for easy teacher modification
- Include clearly written support materials and activities

Evaluating Software

Software needs will vary from one classroom to the next. Four different aspects of evaluating software have been identified by major computer publications. A description of each type of evaluation follows. Each can be used independently or with other types.

SIFTING

Sifting is a general type of evaluation which can be easily and quickly done. The sifting process looks at objectives, cost, and useability to determine if a piece of software can be adapted to fit a particular classroom. If the software objectives mesh with course objectives, if the cost is affordable, and if useability is judged to be easy for your students, the software program is

evaluated highly in the sifting process. The sifting process is diagramed on the following page.

DESCRIPTIVE EVALUATION

Descriptive evaluations are commonly found in educational computer magazines. In narrative form, the evaluator identifies subject matter, specific topics covered, grade and ability level, required hardware and peripherals, and programming languages. Other questions which may be covered in a descriptive evaluation include:

- Does it do what you want in a way that makes sense and is convenient for your students?
- Does it employ the simplest keystrokes?
- Does the program execute in a reasonable amount of time?
- Are the program and supporting materials self-explanatory?
- How are backup copies made?
- Is it possible to erase data accidentally?
- If you press the wrong key will the program "crash" (stop working and lose data)?
- What procedure is used to save data?

PEER EVALUATION

Home economics professionals can share evaluations of software within the field. Based on a conceptual framework for curriculum development and classroom experiences, home economists are the best qualified persons to evaluate software for use in vocational home economics classrooms. Peer evaluation provides:

- Accuracy of content
- Clear, logical presentation of content
- Instructional quality

IN-DEPTH EVALUATION

As a cumulative evaluation method, an in-depth evaluation includes all of the points covered in sifting, descriptive evaluation, and peer evaluation. An in-depth evaluation might include both content and useability evaluations from literature reviews and peer and student evaluations. An in-depth evaluation might also look at the operational factors of the software, educational value, and possible classroom applications. Analysis of objectives, learning content, and evaluation methods are then collectively evaluated. Some additional questions might be asked such as:

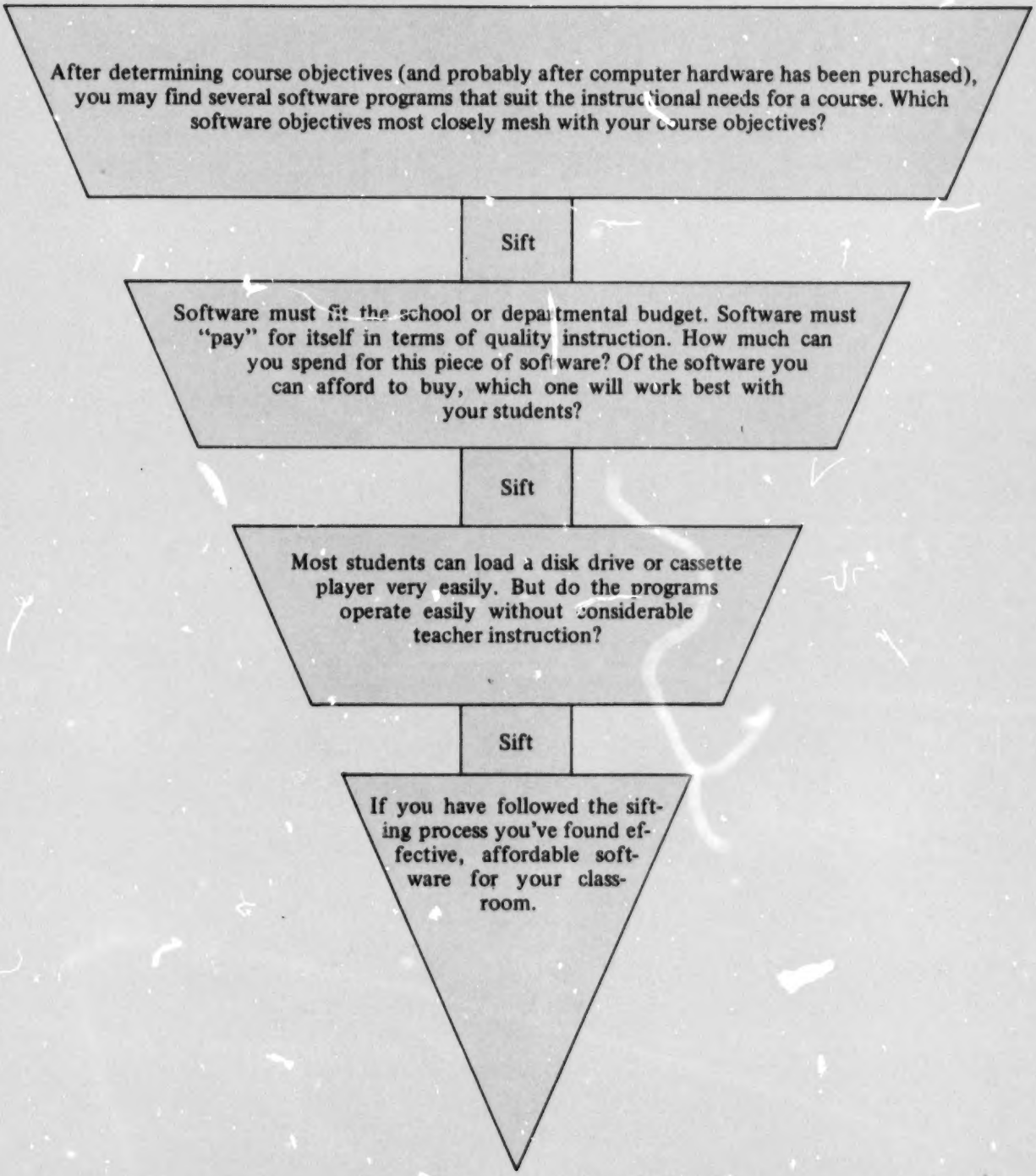
- Is the software motivational?
- Is the software creative?
- Does the software control the rate of learning or does the learner control the rate software material is presented?

SOFTWARE EVALUATIONS–OTHER FACTORS

Some general concepts of education must apply to software used in a home economics classroom. Sometimes general concepts are difficult to quantify, so the teacher must depend on professional judgment for the teaching/learning process.

Software programs, no matter how well structured, must be suited to student abilities, classroom setting, and teacher

THE SIFTING PROCESS


After determining course objectives (and probably after computer hardware has been purchased), you may find several software programs that suit the instructional needs for a course. Which software objectives most closely mesh with your course objectives?
Sift
Software must fit the school or departmental budget. Software must "pay" for itself in terms of quality instruction. How much can you spend for this piece of software? Of the software you can afford to buy, which one will work best with your students?
Sift
Most students can load a disk drive or cassette player very easily. But do the programs operate easily without considerable teacher instruction?
Sift
If you have followed the sifting process you've found effective, affordable software for your classroom.

introduction and summary. Five fundamental questions about educational criteria are listed on the following page. Apply the criteria to particular software programs.

	Characteristics of a Good Learning Situation	
○	1. Is the learning right?	○
	• Check software for accurate content.	
	• Check software for current content.	
○	• Check software for compatible philosophies.	○
	2. Is the learner ready?	
○	• Assess students' intellectual readiness.	○
	• Assess student's emotional readiness.	
	• Assess student's physical readiness.	
○		○
	3. Is the learning managed?	
	• Identify objectives.	
○	• See that learning experiences match objectives.	○
	• Plan evaluation to see if objectives are met.	
○	4. Is the assimilation practical?	○
	• Check software for logical order.	
	• Check software for appropriate repetition.	
○	• Check software for operating ease.	○
	5. Is the learning efficient?	
○	• Assess individual learning differences.	○
	• Assess class time available.	
	• Assess cost relative to educational value.	

Through evaluation using any or all of these evauation concepts can teachers of home economics select classroom-appropriate software. For your convenience, evaluation tools are included in the appendices.

Storing and Cataloging Software

After software is selected, it must be stored and cataloged just as a library might store books or films. Storing software is relatively simple, yet getting organized from Day One will help students best use software and help a teacher keep it on current inventories for ordering and evaluation purposes.

STORING SOFTWARE

Disks, enclosed in protective paper covers can be effectively stored vertically, just as audio records are stored. They are best stored at room temperature with moderate humidity. Dust, which can change the surface of the disk and affect its use, and static electricity, which can accidentally erase information stored on a disk, should be avoided. Dust can be avoided by storing software in protective covers. A build-up of static

electricity can be avoided by using microcomputers only in non-carpeted areas or using an aerosal static controller on carpeting.

For most classroom use, a backup disk copy is made. The original is generally stored away permanently, and students have access only to the backup copy. Instructions on how to make a backup copy are found in Chapter 7.

CATALOGING SOFTWARE

Establishing an efficient software library may seem like an ambitious chore as you invest in your first pieces of instructional software. However, if you wait the chore may be too time-consuming to tackle. A simple library cataloging system is needed. The system which follows is adaptable to most home economics classrooms. Software disks should be labeled with a simple filing code and cross referenced with a card, similar to one used in a library card catalog.

ASSIGNING CALL LETTERS AND NUMBERS

Many libraries catalog software just like a book, assigning it a call number from the Dewey Decimal System or the Library of Congress System. Such a system offers the flexibility necessary for a library. A classroom software library probably doesn't need such a complex system. A simple cataloging system might use content area abbreviations to classify home economics software. The list below contains abbreviations suitable for a simple cataloging system:

Consumer and Homemaking Education

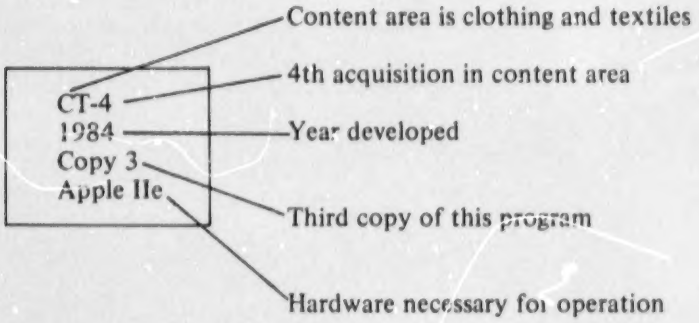
CD Child Development
CE Consumer Education
CT Clothing and Textiles
FH Family/Individual Health
FL Family Living and Parenthood
FN Food and Nutrition
GH General Home Economics
HF Housing, Home Furnishings, and Equipment
HM Home Management

Occupational Home Economics

CC Child Care and Guidance Management and Services
CS Clothing, Apparel, and Textiles Management, Production, and Services
FS Food Production, Management, and Services
HF Home Furnishings and Equipment, Management, Production, and Services
IM Institutional, Home Management, and Supporting Services
GE General Employability Competencies

Other codes might include: CR–careers, CM–classroom management, or ID–instructional design.

Each acquisition in a content area should be numbered in the order they are acquired. Other information might include year of publication (helpful in identifying updated software), copy number (if you have made or purchased back-up copies of the same program), and compatible hardware (if you use more than one brand or model). A sample label follows:



A self-adhesive label is included with most software. Write or type a label before sticking on the disk cover. Pressure on a disk could cause the disk to "crash."

SETTING UP A CARD CATALOG

Once each piece of software is labeled, it should be cataloged. One cataloging system modified from a traditional library card catalog system can be easily used to catalog software in a home economics classroom.

An entry card, filled with pertinent information, might be useful for students trying to locate software or a teacher keeping track of software for inventory or instruction purposes. Information to include on an entry card might be:

- subject area
- number
- hardware required
- program title (followed by author, if provided)
- source/author. (place, company, person)
- status (public domain, copyrighted)
- date (year developed)
- software package components
- content description
- instructional method (drill and practice, tutorial, simulation, etc.)
- grade level
- hardware compatibility (hardware required, memory size, disk operating system)
- necessary peripherals
- cost

An example of such a card follows. A 4 by 6 inch index card will hold most pertinent information. The card has five sections including a call number, general information, description, equipment requirements, and cost.

FN-6
1983
Apple II/IIe/III

EAT SMART. Minneapolis, MN: The Pillsbury Company, copyrighted 1983. One 5-1/4" disk, program manual, educator's guide, supplementary materials.

Description: Analyzes percentages of each user's Recommended Dietary Allowance (RDA) for eight nutrients and considers age, sex, and special requirements for pregnant or lactating women. Also gives calories, total milligrams of sodium and cholesterol, and percentages of calories from fat. Tutorial. GR: 7-12.

Equipment: Apple II (48K, DOS 3.3). Also Apple IIe and Apple III. Printer Optional.

Cost: $19.75

Glossary

acoustic modem
A peripheral device which allows the user access through a standard telephone. See also **coupler**.

alignment notches
Notches at the bottom of a disk cover which are used to ensure that the disk is placed correctly inside the disk drive.

amber monitor
A monochrome videomonitor that displays amber text on a black background.

American Standard Code for Information Interchange (ASCII)
A standardized code used extensively in data transmission. The code includes 128 upper- and lower-case letters, numerals, and special purpose symbols each encoded by a unique 7-bit binary number.

assembler
A language translator that converts a program written in assembly language into an equivalent program in machine language.

authoring software
A software system which allows teachers to load their own educational materials into a pre-programmed framework.

automatic answer modem
A modem which will answer a telephone when it rings and sends out a carrier tone.

automatic dial modem
A modem that will automatically dial a telephone number which is entered on the keyboard.

backup
Copy of an original disk to be used instead of the original. If the backup disk is damaged another one can easily be made from the original.

bar code
A series of line which represent a number, title, or name of an item and can be "read" by a computer. The Universal Product Code found on grocery items is an example of a bar code.

bar code wand
A device which looks much like a thick ballpoint pen with a light shining through the tip; "reads" a bar code.

barrel distortion
A slight outward curvature which can occur on some monitors.

BASIC
A high level programming language designed to be easy to learn and use. BASIC stands for Beginner's All-purpose Symbolic Instruction Code.

baud rate
Measurement of speed at which information can be sent through the I/O port.

bi-directional printer
A printer which prints first from left to right, then from right to left.

binary system
A number system that uses only two digits, 0 and 1, to express all values.

bit
The basic unit of computer memory. Short for binary digit.

black and white monitor
A monitor which displays white letters on a black background.

block-addressable graphics
Graphics where blocks of dots are controlled by a printer. These are less versatile than dot-addressable graphics.

booting
The process of starting up a computer by loading a program into memory from an external storage medium such as a disk.

break key
A key on a computer keyboard which ends execution and returns control of the computer to the user. See also **escape key**.

buffer
A device within a computer that serves as a temporary memory or a temporary workspace in memory. A buffer is frequently used to hold data being passed between the computer and I/O devices. It accommodates different rates of data production and transfer.

bug
An error in a program that causes it not to work as intended.

byte
A group of eight bits usually treated as a unit. One byte generally stores one letter, number, or space.

caps lock key
Position of this key determines whether letters entered will be upper-case only or upper- and lower-case.

card reader
A device that reads, or senses, holes in cards, transforming the data from patterns of holes to patterns of electrical pulses.

carrier tone
The message to a distant modem that the computers can now "talk" to each other.

cassette tapes
A medium of storage used by some types of microcomputer systems.

catalog
Table of contents on a disk. See also **menu, library** or **directory.**

centering hole
Keeps disk in place when in a disk drive.

Central Processing Unit (CPU)
The "brain" of the computer which performs the arithmetic, logic, and control functions of processing.

characters per second (CPS)
A measurement of time which indicates the numbers of characters per second a printer can generate written material.

chip
A microprocessing "chip" containing the electronic components which provide computing power.

COBOL
A computer language designed expressly for business and commercial applications. COBOL stands for COmmon Business-Oriented Language.

color monitor
A computer video display screen which uses colors to enhance graphics.

columns
The number of characters which can be displayed per line on a videomonitor or TV set.

compiler
A language translator that converts a program written in a high-level programming language into an equivalent program in some lower-level language (such as machine language) for later execution.

composite monitor
A color monitor that is less expensive and lower quality than RGB monitors.

computer
A machine which can receive, store, and retrieve information.

computer graphics
A planned method of turning on and off lights on the monitor.

computer networks
Computer facilities with multiple computers sharing one mass storage device.

conversational language
Any computer language that pauses for user responses to questions. See also **interactive language**.

copy protected
A process by the producer of building mechanical or coding barriers into a computer disk or program so that copies cannot be easily made from the original.

copyright
A legal protection which prohibits the copying of information recorded on a storage medium; most commercially marketed computer software is copyrighted.

correspondence quality
A 7 x 9 rectangular dot pattern used by some dot matrix printers to form letters. The large number of dots produces "readable" materials suitable for correspondence.

coupler
A peripheral device which allows the user access through a standard telephone. See also **acoustic modem**.

courseware
Educational programs.

cursor
A dot of light displayed on the monitor to indicate where the next character that is typed will appear. See also **prompt**.

direct-connect modem
A modem which plugs into a standard wall socket or modular telephone jack.

directory
Table of contents on a disk. See also **catalog, menu, or library**.

disk
A rotating circular plate coated with a magnetic material on which data are stored.

disk drive
The hardware device which operates the disk.

disk operating system
The program which instructs the computer's CPU how to transfer information to and from a disk.

display screen
A device that exhibits information visually.

documentation
Paper information accompanying software and hardware.

dot-addressable graphics
Very sophisticated graphics consisting of many tiny dots "drawn" by a printer.

dot matrix printer
A printer that represents characters by printing patterns of dots at selected positions on a fixed-size grid.

double density disk
A disk which stores twice as much information as a single density disk.

double sided disk
A disk on which information is stored on both sides.

draft quality
A pattern of dots, usually 5 dots wide by 7 dots high, used by some dot matrix printers to form letters. This small number of dots produces low quality printed materials suitable for draft copy, but not for correspondence.

drill and practice
Instructional material presented in a repeated fashion.

enter key
A key on a computer keyboard which functions like the carriage return on a typewriter by indicating the end of a line and causing the cursor to move to the beginning of the next line and/or it causes the entry of a command when you are giving commands to the computer. See also **return key**.

error messages
A message which appears on the video display from the disk operating system software, the language interpretor, or even the application program to indicate an error in programming.

escape key
A key used to terminate execution and return control of the computer to the user. See also **break key**.

fanfold paper
Paper with a perforated strip of holes along side edges. Sheets are also perforated to allow the paper to fold fan-like without stopping at the end of each page. See also **sprocket paper** or **tractor feed paper.**

file
A collection of information stored as a named unit on a peripheral storage medium such as a disk.

floppy disk
A soft, thin plastic disk inside a protective cover on which programs can be magnetically coded and read.

flow chart
A graphic description of the steps in a program.

form feed control
Control which automatically advances the paper to the next sheet.

form length control
Control which allows user to control the number of lines printed per sheet.

formatting
The process of preparing a blank disk to receive information by dividing its surface into tracks and sectors. See also **initialize.**

formed character printer
A printer which works by striking the type against a ribbon to produce letters on paper the same way a typewriter does.

FORTRAN
A computer language developed for solving problems in mathematics, engineering, and science. Now also used in business and education. FORTRAN stands for FORmula TRANslator.

graphics tablet
An image input device that allows the user to enter pictorial information directly into the computer by sketching or tracing any shape or series of shapes on the tablet surface.

green phosphorous monitor
A monitor with white or yellow characters on a green background.

hard disks
A rigid disk, coated with a magnetic material, on which information is stored. Hard disks can store more information than floppy disks.

hardware
The physical parts of the computer system.

head access window
Part of the disk cover which allows the head of the disk drive to read and write on the magnetic disk surface.

high-level languages
Computer languages that use commands and concepts similar to English. (Examples: BASIC, PILOT, Pascal, Logo, FORTRAN, and COBOL)

hub-protection ring
A protective ring around the center hole and around the outside edge of a floppy disk. It protects the edges of the disk from wear or damage.

index hole
A hole near the center hole of a floppy disk that is used by some computers to tell where sectors start.

index hole window
A small round opening near the centering hole of a floppy disk. It provides the disk drive access to the small index hole in the disk.

initialize
To prepare a blank disk to receive information by dividing its surface into tracks and sectors. See also **formatting.**

input device
A unit which accepts new data and sends them into the computer for processing.

input/output (I/O) ports
Passage of information into or out of the computer.

interactive language
Any computer language that pauses for user responses to questions. See also **conversational language.**

interface
A device or program that permits one part of a computer system to work with or "communicate" with another, as when making a connection between a cassette tape recorder and a computer; to logically connect two or more devices.

interface board
A small board with ROM (Read Only Memory) chips on it. These ROM chips contain permanent instructions to tell a peripheral when to turn on and off, etc.

interpretor
A language translator that reads a program written in a particular programming language and immediately carries out the actions that the program describes.

in-use light
A light on the front of a disk drive which indicates the disk drive is operating.

jet ink printer
A new type printer that makes fully formed characters by spraying ink on the paper through a tiny ink jet. Jet ink printers are fast, produce high quality print, and are relatively expensive.

joystick
A hand-held control used in games to direct the movement of objects on the display screen.

keybounce
Action by a keyboard which results in repeated letters. This is a malfunction.

kilobytes (K)
1,024 bytes of information that can be stored in the computer system. 16K memory means that the computer can store 16 times 1,024 bytes of data.

language translator
A system program that reads a program written in a particular programming language and either executes it directly or converts it into some other language.

library
Table of contents on a disk. See also **catalog, menu,** or **directory.**

light pen
A small wand-like device used to draw sketches on the screen for input into a computer.

load
The transfer of bytes of information from storage (cassette, cartridge, or disk) to the internal memory of the computer.

logic seeking printer
A printer which automatically moves to the next printing point. See also **smart printer.**

Logo
A simple, fairly new programming language designed to teach programming to children by using computer graphic display capabilities.

low-level language
A programming language in which programs are expressed in a form relatively close to the form the computer can execute directly.

machine language
Coded numbers, 1's and 0's, which are decoded by the central processing unit.

memory
The amount of information (measured in kilobytes) which can be stored either temporarily or permanently in the computer's memory chip.

menu
Table of contents on a disk. See also **catalog, library,** or **directory.**

microcomputer
A fully operational small computer that uses a microprocessor as its CPU.

microcomputer system
Separate components put together to receive, store, and retrieve information.

microprocessor
A single circuit which performs the functions of the central processing unit.

modem
A device that enables computers to communicate over telephone lines.

monitor
A television receiver or CRT device used to display computer output.

monitor program
A system program used for directly inspecting or changing the contents of main memory.

motherboard
Interconnecting network for all chips to plug into a plastic board.

mouse
A device for moving the cursor on the monitor screen.

networking
A structural connection of computer systems and/or peripheral devices, working together to exchange data.

non-startup disk
A disk which contains no operating system.

numeric keypad
A keyboard where number keys are arranged like a 10-key adding machine or calculator.

on-line switch
A switch on the computer which permits disconnecting the printer from the computer while the user changes the paper, advances the paper by hand, or performs other operations. See also **printer on-off switch.**

operating system
A software system that organizes the computer's capabilities and makes them available to the user.

output
Information transferred out of the computer for display, storage, or control.

output device
Any device which allows the computer to communicate with you. A television-like monitor or display terminal is the most common output device.

overscan
A condition in which the image overflows the screen's edge.

paddle
A device used to move objects around on the monitor.

parallel I/O port
Ports which allow the computer to send one character of information in or out of the computer at a time.

Pascal
A high-level programming language designed to teach programming as a problem-solving discipline.

peripherals
A general term used to describe all the various machines which operate with the microcomputer but are actually not part of it. Peripheral devices can include printers, keyboards, graphic display terminals, disk drives, joysticks, and mice.

PILOT
A high-level language designed for teachers to design instructional software. PILOT stands for Programmed Inquiry, Learning, Or Teaching.

pin-feed printer
A printer which uses both pins and a roller working together to move paper through. See also **tractor feed.**

plotter
A device used in conjunction with a computer to plot coordinate points in the form of a graph.

printer on-off switch
A switch on the computer which permits disconnecting the printer from the computer while the user changes the paper, advances the paper by hand, or performs other operations. See also **on-line switch.**

program
An organized group of instructions that tell the computer what to do.

programming languages
A set of rules or conventions for writing programs.

prompt
A program or computer-generated message to the user; to prompt an appropriate user command or response.

proportional spacing
Printer spacing which provides more space for a wide letter, such as "W," than for a narrow letter, such as "I."

public domain
The status of non-copyrighted and non-copy protected software available for anyone to reproduce at no cost for permission to use.

Random Access Memory (RAM)
Computer memory structured so that the time required to access any data item stored in the memory is the same for any other item.

Read Only Memory (ROM)
Information placed in the computer during manufacturing. It does not disappear when the computer is turned off.

repeat key
Allows the user to repeat a character without striking the character key repeatedly.

reset key
A key which restarts the system when the power is on, stops a program, or starts the computer's built-in self-test.

resolution
The number of individually accessible points on the display screen, usually expressed as the number of horizontal display points by the number of vertical display points.

return key
Functions like the carriage return on a typewriter by indicating the end of a line and causing the cursor to move to the beginning of the next line. It also causes the entry of a command when user is giving commands to the computer. See also **enter key.**

RGB monitor
A red-green-blue color monitor. RGB monitors produce the greatest sharpness of color monitors and are the most expensive.

saving a disk
A procedure for permanently storing a program by transferring it to a blank space on a disk.

scrolling
The effect on a display screen of information shifting from top to bottom as if it were written on a scroll.

sectors
A portion of a disk. (On some disks there are 16 sectors per track.)

self-test control
A test pattern to ensure that a printer is working properly.

serial I/O
A method of data transfer between a computer and a peripheral device in which data are transmitted for input to the computer or output to the device bit by bit over a single circuit.

shift keys
Keys, which when depressed, allow the user to type the upper character printed over some of the keyboard keys.

simulations
An educational experience where students answer questions relative to "real world" settings.

single density disk
A disk which stores about half as much information as a double density disk.

smart printer
A printer which automatically moves to the next printing point. See also **logic-seeking printer**.

software
Programs which control the operation of computer hardware.

space bar
A bar on the computer keyboard which functions the same on a computer as on a typewriter.

special function keys
Keys found on a microcomputer keyboard which are not normally found on a typewriter keyboard.

speech recognition unit
A computer peripheral which recognizes different sound patterns.

speech synthesizer
A peripheral device which imitates the human voice.

spread sheets
A general ledger bookkeeping software program.

sprocket paper
Paper with a perforated strip of holes along side edges. Sheets are also perforated to allow the paper to fold fan-like without stopping at the end of each page. See also **fanfold paper** and **tractor feed paper.**

startup disk
A disk used to set a system into operation. Also called **auto-booting disk.**

storage device
A device into which data may be inserted, in which they may be retained, and from which they may be retrieved.

subscripts
Lowered letters or numbers such as the 2 in H_2O.

superscripts
Raised letters or numbers such as the 2 in X^2.

teletype paper
Rolls of paper used in some printers.

terminal emulator program
A software program which interprets data base information for the computer.

thermal printer
A peripheral device which forms letters on special oxide-treated paper.

tracks
A circular bond at a fixed distance from the recording surface of a disk.

tractor
An adjustable sprocket which pulls paper into a printer. See also **sprocket.**

tractor feed
A type of printer paper feed where adjustable sprockets pull paper through the printer.

tractor feed paper
Paper with a perforated strip of holes along side edges. Sheets are also perforated to allow the paper to fold fan-like without stopping at the end of each page. See also **fanfold paper** and **sprocket paper.**

true descenders
The lower part of some lower-case letters which extend below the baseline of print, specifically the letters g, j, p, q, and y; extending the descenders below the baseline of type makes the printed text easier to read.

turtle graphics
A feature in Logo which makes it possible for the user to create geometric designs by moving the cursor (turtle) using simple commands.

tutorial
Software program where users are given informational material and asked questions pertaining to the information.

Universal Product Code
A bar code adopted by the food retailing industry. A computer scanning system reads the price code at the check-out counter and simultaneously removes the item from the shelf inventory list.

user-friendly
Programs made relatively easy for non-expert users. Uses English words and phrases for "prompts" within the program. These allow users to add in necessary information to use the program without ever working directly with the programming.

viewports
All or part of the display screen, used by an application program to display a portion of the information that the program is working on.

word processing
A system providing the capability of formatting text quickly and efficiently.

word processing software
Software that allows the user to format text efficiently by correcting words, deleting words, moving lines or paragraphs, or correcting punctuation quickly.

write-protect
A process to protect the information on a disk by covering the write-protect notch with a write-protect tab, preventing any new information from being entered on the disk.

write-protect notch
The square cutout in the edge of a disk's jacket that permits information to be written on the disk.

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Appendices

Evaluator _____
Date _____

Software Evaluation Form 1

Program Name: _____

Copyright Date: _____

Computer Needs: _____

Peripheral Needs: _____

Program Type: _____

Content Area: _____

Grade Level: _____

General Description:

Major Strengths:

Major Weaknesses:

Overall Rating:

Comments:

Evaluator _____
Date _____

Software Evaluation Form 2

Name of Program: _____

Copyright Date: _____ Distributor: _____

Cost: _____ Address of Distributor: _____

Source: _____

Hardware (brand, model, memory): _____

Peripherals: _____

Software Medium (tape, cartridge, disk): _____

Documentation: _____

Program Type (circle one): drill/practice tutorial simulation other

Subject Area: _____

Specific Information (Check one.):

	Excellent	Good	Fair	Poor	N/A
Clear Documentation	☐	☐	☐	☐	☐
Easy to Load	☐	☐	☐	☐	☐
Grade Level Appropriateness	☐	☐	☐	☐	☐
Subject Area Appropriateness	☐	☐	☐	☐	☐
Program Length	☐	☐	☐	☐	☐
Quality	☐	☐	☐	☐	☐
Pace	☐	☐	☐	☐	☐
Directions	☐	☐	☐	☐	☐
Reinforcement	☐	☐	☐	☐	☐
Branching	☐	☐	☐	☐	☐
Graphics	☐	☐	☐	☐	☐
Logical Order	☐	☐	☐	☐	☐

Evaluator: _____
Date: _____

Software Evaluation Form 3

Program Title: _____

Publisher: _____

Microcomputer (brand, model, memory): _____

Medium (disk, cartridge, tape): _____

Peripherals: _____

Appropriate Grade Levels (Circle.): Preschool K 1-3 4-6 7-9 10+

Remedial Enrichment

Type of Program: _____ drill/practice _____ tutorial _____ simulation

_____ authoring system _____ word processing _____ spread sheet

_____ other (Please Specify.) _____

Program Objectives (List.):

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Complete the form on the following page.

Specific Information (Check one.):

	Yes	No	N/A
Content			
Are objectives clearly stated?	____	____	____
Is content accurate?	____	____	____
Is content current?	____	____	____
Is difficulty appropriate to learners?	____	____	____
Is material sex-bias free?	____	____	____
Student Use			
Is documentation clear?	____	____	____
Are instructions clear?	____	____	____
Can students easily access instructions?	____	____	____
Can students easily access menu?	____	____	____
Is program easy to read?	____	____	____
Is starting the program easy?	____	____	____
Is completing a program easy?	____	____	____
Does color enhance the program?	____	____	____
Does sound enhance the program?	____	____	____
Can students control the pace?	____	____	____
Teacher Use			
Can teacher modify the program?	____	____	____
Can teacher receive student scores?	____	____	____
Can software be easily employed in the classroom?	____	____	____
Would you recommend the use of this software?	____	____	____
Would you purchase this software?	____	____	____

Comments: